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Aerospace Medicine
and Biology
A Continuing
Bibliography
with Indexes

NASA SP-7011 (180)
May 1978

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ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges:

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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 180)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in April 1978 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA)*



Scientific and Technical Information Office

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National Aeronautics and Space Administration

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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* (NASA SP-7011) lists 201 reports, articles and other documents announced during April 1978 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of the bibliography was published in July 1964; since that time, monthly supplements have been issued.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects of biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged in two major sections: *IAA Entries* and *STAR Entries*, in that order. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the slight variation in citation appearances.

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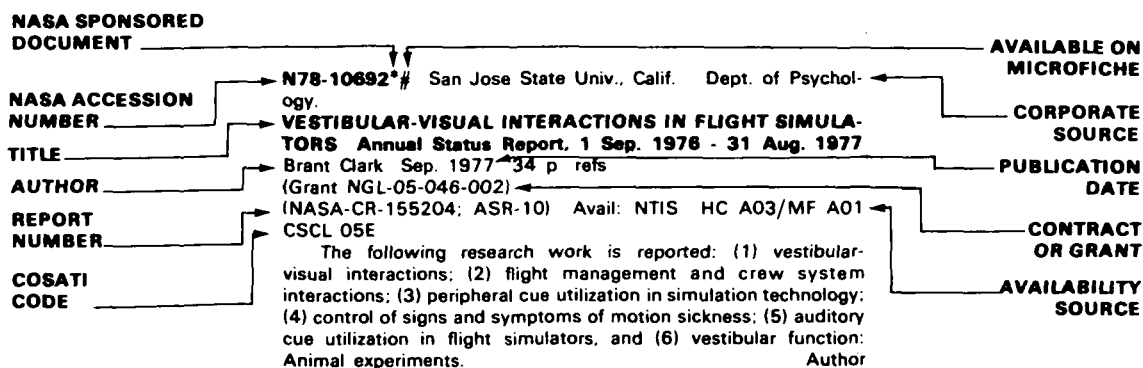
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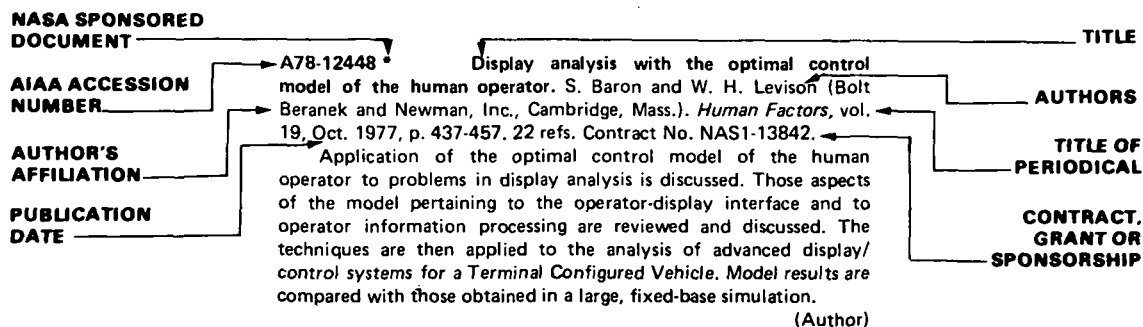
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TYPICAL CITATION AND ABSTRACT FROM /AA



AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 180)

MAY 1978

IAA ENTRIES

A78-20822 # Regulation of the functional activity of human cells by means of laser radiation (Regulirovanie funktsional'noi aktivnosti kletok cheloveka s pomoshch'iu lazernogo izlucheniia). B. I. Stepanov, V. A. Mostovnikov, A. N. Rubinov, and I. V. Khokhlov (Akademiia Nauk Belorusskoi SSR, Institut Fiziki, Minsk, Belorussian SSR). *Akademiia Nauk SSSR, Doklady*, vol. 236, Oct. 1, 1977, p. 1007-1010. 10 refs. In Russian.

The ability of binary combinations of laser irradiation (wavelengths 347, 441, 632, 694, and 741 nm) to increase or decrease the number of chromosome aberrations induced in monolayer cultures of human skin-muscle cells by powerful laser irradiation or ionizing radiation is studied. The ratio of mitotic indices in experimental and control cells was also determined. Irradiation at 347 nm increased the number of chromosome aberrations to a greater extent when it followed radiation at another wavelength than when it preceded the other wavelength. Irradiation at 632 nm had a slight radioprotective effect. M.L.

A78-20844 # Laws of reproduction of memory traces in time (O zakonomernostiakh vosproizvedeniia pamiatnogo sleda vo vremeni). A. T. Bondar' (Akademiia Nauk SSSR, Institut Biologicheskoi Fiziki, Pushchino-on-Oka, USSR). *Akademiia Nauk SSSR, Doklady*, vol. 236, Oct. 21, 1977, p. 1503-1505. 14 refs. In Russian.

Experiments were conducted on 170 12-year olds to study dynamic memory processes by constructing retention curves, which reflect minute, hour and day intervals up to 30 days. The subjects were divided into groups of five or (under certain conditions) ten and had to recall number sequences that were spoken to them. Data analysis revealed that the reproduction coefficient has an oscillatory character on the background of memory loss with time. This oscillatory character is found to be nonharmonic but governed by a definite law which seems to reflect a stage of memory not as a systemic function, but as an active, dynamic process (the 'memory trace'). B.J.

A78-21176 # Role of humoral-hormonal factors in human predisposition to motion sickness (Rol' gumoral'no-gormonal'nykh faktorov v predispolozhennosti cheloveka k ukachivaniu). G. N. Kassil' and B. I. Poliakov. *Fiziologiya Cheloveka*, vol. 3, July-Aug. 1977, p. 614-619. 21 refs. In Russian.

The paper examines the characteristics of organizing the autonomic-humoral-hormonal system with respect to blood levels and intercorrelations of epinephrine, norepinephrine, acetylcholine, histamine, and serotonin in male adult subjects (21-40 yr) predisposed and nonpredisposed to motion sickness. It is shown that for individuals predisposed to motion sickness the trophotropic mechanisms are predominant, while for subjects without predisposition to motion sickness the ergotropic mechanisms prevail. A mathematical

model is developed which describes the relationship between the level of vestibulo-autonomic stability and the blood levels of biologically active substances, enabling prediction of vestibular stability. S.D.

A78-21177 # Influence of vestibular stimuli on adrenergic and cholinergic activity of blood (Vliianie vestibuliarnykh razdrazhenii na adren- i kholinergicheskuiu aktivnost' krovi). B. I. Poliakov, E. Sh. Matlina, and R. A. Sokolinskaia. *Fiziologiya Cheloveka*, vol. 3, July-Aug. 1977, p. 620-624. 20 refs. In Russian.

The dynamics and relationship between the adrenergic and cholinergic activities of blood are investigated in 43 healthy male individuals (21-36 yr) subjected to experimental motion sickness. It is found that individuals subjected to motion sickness exhibit increased cholinergic and adrenergic activities of blood with pronounced release (+690%) of epinephrine with respect to its initial level; 30 min after its action, its blood content is still high. The data point to the significant pathogenetic role of the insufficiency of the mechanism of acetylcholine inactivation due to its bonding to in-vivo erythrocytes. The results obtained extend the concepts about motion sickness pathogenesis and reveal new ways of rational pathogenetic therapy. S.D.

A78-21178 # Investigation of the regulation system for vertical posture by means of vibrational stimulation of muscle spindles (Issledovanie sistemy regulatsii vertikal'noi pozy vibratsionnoi stimulatsiei myshechnykh vereten). V. S. Gurfinkel', M. I. Lipshits, and K. E. Popov (Akademiia Nauk SSSR, Institut Problem Peredachi Informatsii, Moscow, USSR). *Fiziologiya Cheloveka*, vol. 3, July-Aug. 1977, p. 635-643. 30 refs. In Russian.

Experiments were conducted to study the peripheral (reflex responses) and central (motion illusion) effects related to the electromechanically induced vibration of Achilles tendons in man during maintenance of vertical posture and during resting sitting position. It is shown that the same impact on the proprioceptive afferent complex gives rise to different effects as a function of the postural task. In the sitting position, vibrational stimulation produces a tonic vibrational reflex, regarded as a stretch reflex, and an illusion of foot motion; in the erect position, vibration causes deflection of the body to the rear with reflex activation of distant muscles, while body fixation elicits tilting illusion of the whole body forward. S.D.

A78-21179 # Effect of antiorthostatic exposure on heart-rate dynamics and quality of tracking by human operator (Vliianie antiortostaticheskogo vozdeistviia na dinamiku chastoty serdechnykh sokrashchenii i kachestvo slezheniia cheloveka-operatora). Sh. T. Avetikian, A. M. Zingerman, and D. N. Menitskii (Akademiia Meditsinskikh Nauk SSSR, Leningrad, USSR). *Fiziologiya Cheloveka*, vol. 3, July-Aug. 1977, p. 678-684. 21 refs. In Russian.

The present experimental study aims at studying the functional characteristics of cardiovascular and sensorimotor systems of a human operator during antiorthostatic exposure and following cessation. All experiments involved three operating regimes: (1) horizontal position of the body for 10 min; (2) negative tilting of the head at -45 deg for 20 min; and (3) returning to the horizontal

position and maintaining it for 20 min. Differences in results of tracking performance and heart-rate dynamics during antiorthostatic exposure at -45 deg for 20 min suggest dividing the individuals into adaptive and nonadaptive classes, where performance quality is higher in the former. S.D.

A78-21180 # Oxygen consumption and some indicators of external respiration during cold adaptation (Potreblenie kisloroda i nekotorye pokazateli vneshnego dykhanii pri adaptatsii k kholodu). M. A. Iakimenko, T. V. Neshumova, and E. Ia. Tkachenko (Akademii Meditsinskikh Nauk SSSR, Novosibirsk, USSR). *Fiziologiya Cheloveka*, vol. 3, July-Aug. 1977, p. 717-719. In Russian.

A78-21181 # Mechanism of bifixation in the act of binocular vision (Mekhanizm bifiksatsii v akte binokuliarnogo zreniia). E. S. Avetisov, A. M. Kotliarskii, and I. L. Smol'ianinova (Moskovskii Nauchno-Issledovatel'skii Institut Glaznykh Boleznii, Moscow, USSR). *Fiziologiya Cheloveka*, vol. 3, July-Aug. 1977, p. 720-724. In Russian.

A device is developed for recording binocular movements of the eyes, the sensitive element being represented by an electromagnetic transducer installed in a contact lens. For the first time the device made it possible to obtain a simultaneous recording of the movements of both eyes during binocular fixation of an object, i.e. the field of bifixation, while its central compact portion is typical of fusion field; the boundaries of this field in the vertical and horizontal directions constitute 3-4 and 5-10 arcmin, respectively. The behavior of bifixation field is different from that of monocular fixation field, so that results of monocular recording of eye movements cannot give a sufficiently complete picture of the activity of the visual system insofar as under normal conditions the binocular visual system prevails over the monocular vision. S.D.

A78-21182 # Human physiological responses during swinging with periodic rotations (Fiziologicheskie reaktsii cheloveka pri kachanii s periodicheskimi vrashcheniiami). F. A. Soledovnik. *Fiziologiya Cheloveka*, vol. 3, July-Aug. 1977, p. 725-730. 27 refs. In Russian.

Experiments were conducted on 19 healthy male subjects without vestibular symptoms in order to evaluate the severity of vestibulo-autonomic, sensory and somatic responses as well as endurance to swinging and to simultaneous swinging and periodic rotations. It is found that at the start of swinging and during simultaneous swinging and rotations the heart rate is increased and respiration rate rises only during rotations that accompany swinging. Swinging with periodic rotations elicits motion sickness somewhat faster than simple swinging or rotation. Changes in the vestibulo-autonomic responses to linear and angular accelerations as well as to combined swinging and rotation are due to the stimulation of the vestibular system and the emotional factor involved. S.D.

A78-21183 # Physiological responses under the action of Coriolis acceleration (Fiziologicheskie reaktsii pri deistvii uskorennii Koriolisa). V. V. Usachev and I. P. Shinkarevskaya (Ministerstvo Zdravookhraneniia SSSR, Institut Mediko-Biologicheskikh Problemy, Moscow, USSR). *Fiziologiya Cheloveka*, vol. 3, July-Aug. 1977, p. 731-734. 17 refs. In Russian.

The state of intracranial and systemic circulation in man at different stages of motion sickness due to Coriolis acceleration is examined. The study disclosed the possibility of prognosis of endurance to low accelerations on the basis of analysis of hemodynamic changes. It is shown that during motion sickness the minute volume of blood is not reduced significantly. S.D.

A78-21184 # Hypokinesia and readaptation /physiological aspects/ (Problema gipokinezii i readaptatsii /fiziologicheskie aspekty/). T. N. Krupina and B. M. Fedorov. *Fiziologiya Cheloveka*, vol. 3, Nov.-Dec. 1977, p. 997-1005. 23 refs. In Russian.

The paper examines medical investigation data concerning healthy male individuals subjected to antiorthostatic hypokinesia at an angle of -4 deg during a period of 30 days, 49 days, and under hypokinesia in the horizontal position for 120 days. The observations revealed that during hypokinesia there occur hemodynamic and cardiovascular changes; neuromuscular changes; tropic disorders; changes in hormone, water-electrolyte, and energy metabolisms; and changes in CNS. The results suggest that under the action of hypokinesia and concomitant asthenia, the response of CNS is sharply altered, and the emotional susceptibility and stress proneness of the hypokinetic subject are enhanced. Physiologically founded systems of complex rehabilitation measures permit effective stimulation of readaptation processes. S.D.

A78-21195 # Generalized EEG changes in the rabbit during selective cooling and heating of the posterior hypothalamus (Generalizovannye izmeneniia entsefalogrammy u krolikov pri izbiratel'nom okhlazhdenii i nagrevanii oblasti zadnego gipotalamusa). I. K. Iaichnikov (Akademii Meditsinskikh Nauk SSSR, Leningrad, USSR). *Fiziologicheskii Zhurnal SSSR*, vol. 63, Oct. 1977, p. 1398-1402. 16 refs. In Russian.

A78-21196 # Cyclic adenosine-3,5-monophosphate and photoreceptor potential of the retina in vertebrates (Tsiklicheskie adenozin-3,5-monofosfat i fotoretseptorny potentsial setchatki pozvonochnykh). N. L. Sakina, A. V. Minor, and M. A. Ostrovskii (Akademii Nauk SSSR, Laboratoriia Fiziko-Khimicheskikh Osnov Retseptiv, Moscow, USSR). *Fiziologicheskii Zhurnal SSSR*, vol. 63, Oct. 1977, p. 1418-1423. 22 refs. In Russian.

A78-21197 # Efficiency of the myocardium after adaptation to hypoxia (Koeffitsient poleznogo deistviia miokarda posle adaptatsii k gipoksii). Iu. S. Aliukhin and G. P. Ivanov (Akademii Nauk SSSR, Laboratoriia Termoregulatsii i Bioenergetiki, Leningrad, USSR). *Fiziologicheskii Zhurnal SSSR*, vol. 63, Oct. 1977, p. 1446-1450. 9 refs. In Russian.

Isolated working heart specimens of white rats were analyzed to evaluate the influence of prolonged training of rats in hypoxia produced by simulated ascents in an altitude chamber at 7000 m on the mechanical efficiency of the heart and on oxygen consumption of the arrested heart. Major conclusions are that following a 1-2 month adaptation to hypoxia, the mechanical efficiency of the heart is increased and oxygen consumption of the arrested heart remains unchanged. S.D.

A78-21348 # Current problems of neurochemical investigations of memory (Aktual'nye voprosy neirokhimicheskikh issledovaniy pamiati). E. A. Gromova (Akademii Nauk SSSR Institut Biofiziki, Pushchino, USSR). *Uspekhi Fiziologicheskikh Nauk*, vol. 8, Oct.-Dec. 1977, p. 24-44. 112 refs. In Russian.

The current status of information coding on the macromolecular level, chemical transmission of memory, and the role of biogenic amines in memory mechanisms is analyzed from a neurophysiological standpoint. Author's own experimental data and available published literature are combined to develop a theory about the neurotrophic mechanisms of memory. According to this theory, the basis of long-term memory is represented by interneuronal connections determined by patterns of electrical activity for neurons involved in the perception of information. The character of this activity at the level of individual neurons is determined by genetically programmed connections of the synapses with DNA molecules and metabolic processes on which electrogenesis is based. S.D.

A78-21372 # Response of endocrine glands to the directional action of impulsive acceleration (Reaktsiia zhelez vnutrennei sekretsii na napravlennye vozdeistviia impulsnykh uskorennii). P. O. Viazitskii and D. I. Korotkov. *Voenno-Meditsinskii Zhurnal*, Oct. 1977, p. 62-65. In Russian.

A series of 24 tests were conducted on six healthy male individuals (25-34 yr) subjected in the sitting position to horizontal

impulsive accelerations of 2.3-6.15 g for 0.008-0.148 sec; 12 tests involved chest-to-back acceleration and the rest side-to-side acceleration. The objective was to evaluate the effect of directional acceleration on the functional states of the adrenals and the thyroid. The results suggest that both types of directional acceleration sharply enhance the activity of most endocrine glands. The hormonal background changes less during chest-to-back acceleration, while side-to-side acceleration markedly stimulates the thyroid. S.D.

A78-21373 # Variation of the corticosteroid composition of the urine under the action of simulated orthostatic stressing under high-g conditions (Izmenenie kortikosteroidnogo sostava mochi pod vozdeistviem modeliruemoi ortostaticheskoi nagruzki v usloviakh povyshennoi vesomosti). A. V. Sorokin, L. I. Voronin, A. V. Eremin, Iu. A. Kniazev, N. V. Uliatovskii, and A. I. Chekanov. *Voenno-Meditsinskii Zhurnal*, Oct. 1977, p. 68-71. 5 refs. In Russian.

A total of 11 healthy male individuals (25-35 yr) were subjected to a 2.5 g stressful acceleration in a 7 m radius centrifuge at different angles, directions, and periods of action: +Gx, 80 deg, 60 min; +Gz, 0 deg, 220 min; +Gz, 90 deg, 60 min; and +Gz, 0 deg, 20 min. The study aimed at evaluating changes in the corticosteroid composition of the urine in response to the simulated orthostatic stressing and hypergravity conditions as well as at determining the relationship between the functional state of the adrenal cortex and the resistance of the cardiovascular system to the directional stressful accelerations cited. The biosynthesis intensity of glucocorticoids is determined and discussed in terms of an index expressing the relation between their metabolites in the urine. S.D.

A78-21450 Thallium-201 myocardial perfusion scintigraphy for the clinical clarification of normal, abnormal and equivocal electrocardiographic stress tests. E. H. Botvinick, M. R. Taradash, D. M. Shames, and W. W. Parmley (California, University, San Francisco, Calif.). *American Journal of Cardiology*, vol. 41, Jan. 1978, p. 43-51. 35 refs. Grants No. NIH-HL-21793; No. NIH-HV-52989.

Sixty-five patients were studied with stress electrocardiography and thallium-201 relative myocardial perfusion scintigraphy. Results were correlated with selective coronary angiography. Scintigraphy was more sensitive (85 versus 67 percent), more specific (89 versus 63 percent) and significantly more accurate (87 versus 65 percent) than stress electrocardiography for the diagnosis of significant coronary arterial lesions in patients with isoelectric S-T segments at rest. Stress scintigraphy helped clarify the equivocal stress test due to left bundle branch block, left ventricular hypertrophy, drugs, hyperventilation and other conditions and was more accurate than the stress electrocardiogram (89 versus 53 percent) even in the presence of a depressed S-T segment at rest. Thallium-201 scintigraphy is a safe and simple noninvasive method for identifying abnormal myocardial perfusion, stress-induced ischemia and, indirectly, significant coronary arterial lesions. (Author)

A78-21475 # And what is the limit of the minimum (A kakov predel minimuma). A. Bezhevets, V. Ponomarenko, N. Zavalova, and V. Poliakov. *Aviatsiia i Kosmonavtika*, Nov. 1977, p. 26, 27. In Russian.

The article discusses the factors which govern instrument landings including aircraft aerodynamic characteristics, navigation instrumentation, and pilot experience. Attention is also given to the significant subjective factor introduced into the flight by the pilot, noting the response time to instrument-yielded information in terms of pilots of different levels of experience. The sequence of psychological states experienced by a pilot in the landing phase of a flight made during conditions of low cloud cover is described. S.C.S.

A78-21701 Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, February 15-17, 1977, Proceedings. Symposium sponsored by the U.S. Air Force Aerospace Medical Research Laboratory, and National Academy of Sciences - National

Research Council. *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2. 243 p.

Thirty-two papers are presented on biodynamic models and their applications. The papers fall into five subject groups: (1) the prediction of response and injury resulting from localized impact, (2) aircraft emergency escape dynamics and crew injury, (3) the prediction of body response to impact, (4) complex biomechanical models for the prediction of response to mechanical stresses, and (5) prediction of performance in mechanical stress environments. S.C.S.

A78-21702 Nonlinear numerical prediction of human head/helmet crash impact response. K. J. Saczalski (U.S. Navy, Office of Naval Research, Arlington, Va.) and E. O. Richardson (Texas A & M University, College Station, Tex.). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 114-119. 6 refs.

A nonlinear, finite-element, model is used to examine the biodynamic impact response of helmeted and unhelmeted headforms having human response characteristics. The human response headform is modeled as a spherical brain of nearly incompressible material, a covering of linear elastic dura, a linear elastic spherical skull, and a layer of nonlinear scalp material. The helmet system is modeled as a partially spherical, highly nonlinear, helmet liner material and a linear elastic fiberglass helmet outer shell. In the case of unhelmeted head impact, the brain pressure response predictions made with the model achieve good qualitative correlation with experiments on impacted human cadaver heads. The model is then used to investigate the response attenuating characteristics of a range of nonresilient helmet liner materials. The results of the study establish the importance of matching surrogate structural compliance and mechanical impedance to that of the human system being simulated if proper assessment of safety system performance is to be achieved. (Author)

A78-21703 Application of a fluid-filled spherical sandwich shell as a biodynamic head injury model for primates. A. E. Engin (Ohio State University, Columbus, Ohio) and N. Akkas (Middle East Technical University, Ankara, Turkey). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 120-124. 15 refs.

A78-21704 Evaluation of biomechanical response and potential injury from thoracic impact. D. C. Viano (GM Research Laboratories, Warren, Mich.). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 125-135. 7 refs.

An analytical model for the anteroposterior thoracic impact response of the human thorax is investigated to: (1) establish a comparison between the model and available cadaver data for blunt impacts, (2) demonstrate typical force, deflection, and acceleration impact response characteristics as well as additional parameters, such as stored and dissipated energies and associated powers, and (3) develop biomechanical response characteristics for frontal impacts of varying severity (i.e., mass: 2.26 kg and velocity: 2.24 m/s) within the range of model applicability. The analysis provides fundamental relationships between thoracic impact characteristics and biomechanical response and human injury potential. (Author)

A78-21705 Biodynamic finite element models used in brain injury research. C. C. Ward, P. E. Nikraves, and R. B. Thompson (U.S. Navy, Civil Engineering Laboratory, Port Hueneme, Calif.). (U.S. Air Force-Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 136-142. 6 refs. U.S. Department of Transportation Contract No. HS-5-01132.

Three-dimensional finite element models for the monkey, baboon, and human brains have been developed and are described. Isoparametric brick elements and membrane elements represent the soft tissue and partitioning internal folds of dura, respectively. By specifying the finite element mesh on the skull inner surface, the irregular shape of the brain is generated. Each model is subjected to the same skull acceleration to investigate response relationships between species. Important dynamic response differences are revealed by comparing the computed intracranial pressures. Experimentally derived head injury data are correlated with model dynamic responses. Using the baboon and monkey models, brain injury tests are simulated and model response measures are compared to produced injury. Using the human model, computed stresses are compared to intracranial pressures measured in cadaver impact tests. (Author)

A78-21706 Finite element dynamic structural model of the human thorax for chest impact response and injury studies. P. H. Chen (TRW Defense and Space Systems Group, Redondo Beach, Calif.). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 143-149. 14 refs.

The component mode modal synthesis technique has been successfully adapted to the finite element structural dynamic model of the human thorax for chest impact response and injury studies. The complete thorax was modeled as an assembly of a thorax module with viscera subsystems. The module was further subdivided into rib components. Major model development was conducted at the component level to provide cost saving and modeling flexibility. The results show that the thorax can be successfully treated as a linear system. A two-step procedure was developed to obtain viscera response. The analysis results of THORAX III, a first cut thorax model, were favorably compared with Kroell-Nahum cadaver experiments. The sensitivity of the chest response due to variation in input pulse shape and peak force were analyzed. The pulse shape can affect the force-deflection relationships while peak force affects the peak response. Further sensitivity studies and experiments are proposed. (Author)

A78-21707 Identification and classification of vertebral fractures following emergency capsule egress from military aircraft. L. E. Kazarian (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 150-157. 13 refs.

A78-21708 Theory and application of a three-dimensional model of the human spine. T. Belytschko (Northwestern University, Evanston, Ill.), L. Schwer (Illinois, University, Chicago, Ill.), and E. Pritzner (Stanford Research Institute, Menlo Park, Calif.). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 158-165. 14 refs. Contract No. F33615-76-C-0506.

A three-dimensional, discrete model of the human spine, torso, and head was developed for the purpose of evaluating mechanical response in pilot ejection. However, it was developed in sufficient generality to be applicable to other body response problems, such as occupant response in aircraft crash and arbitrary loads on the head-spine system. The anatomy is modeled by a collection of rigid bodies, which represent skeletal segments such as the vertebrae, pelvis, head, and ribs, interconnected by deformable elements, which represent ligaments, cartilaginous joints, viscera and connective tissues. Results are presented for several conditions: different rates of onset, ejection at angles, pre-ejection alignment, and eccentric head loadings. It is shown that slow rates of onset and angling the seat reduce both the peak axial loads and bending moments. In the presence of eccentric head masses, such as helmet-mounted devices, the reflected flexural wave is shown to be the key injury mechanism. (Author)

A78-21709 Distribution of spinal disc pressures in the seated posture subjected to impact. R. J. Arvikar and A. Seireg (Wisconsin, University, Madison, Wis.). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 166-169. NSF Grant No. ENG-76-10761.

A musculoskeletal model for the human spine developed by the authors is used for this study. The model takes into account the equilibrium of the vertebral bodies, the intervertebral discs and segments of the upper extremities under the influence of all major muscle and joint forces. Linear programming techniques are used to obtain the muscle load sharing and the disc pressures, based on a preselected linear criterion. The criterion is formulated as a combination of all muscle forces, joint forces and ligament action, with suitable weighting factors. The model is used to study the effect of sudden forward or backward acceleration forces, such as during the impact situation, on the distribution of disc pressures in the spinal column in the unsupported seated posture. (Author)

A78-21710 Analytical model of the fatigue characteristics of bone. J. F. Lafferty (Kentucky, University, Lexington, Ky.). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 170-174. 13 refs. Contract No. F49260-77-C-0043. USVA Project 596-9471-02.

The existing data for the bending fatigue strength of bone are analyzed to determine the effects of various test procedures for human and bovine bone. Additional experiments, using bovine bone, are presented to evaluate the effects of stress frequency and stress reversal on fatigue life. An analytical model which relates fatigue life to ultimate strength, stress amplitude, stress frequency, and stress reversal is developed. (Author)

A78-21711 Systems identification scheme for the estimation of the linear viscoelastic properties of the intervertebral disc. Y. K. Liu and G. Ray (Tulane University, New Orleans, La.). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 175-177. 9 refs. Grants No. NIH-GM-19107-04; No. NIH-GM-05100-01.

A systems identification scheme is developed to assess the generalized relaxation modulus of the intervertebral disk as it experiences axial and shear loading. A two-dimensional axisymmetric linear viscoelastic finite model is composed of constant strain triangular elements. The model is applicable to determining creep compliance as the relaxation modulus and creep compliance are associated by a simple relation between their Laplace transform.

Expressions may also be derived for the frequency-dependent complex compliance by fitting the estimated relaxation modulus to a three or four-parameter solid-fluid model. S.C.S.

A78-21712 **Biodynamic model of a parachutist.** R. L. Huston, J. M. Winget, and M. W. Harlow (Cincinnati, University, Cincinnati, Ohio). (*U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.*) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 178-182. 38 refs. Contract No. N00014-76-C-0139.

A three-dimensional, gross-motion, finite-segment model of a parachutist is presented. The model is a modification of the UCIN Crash Victim Simulation Code. It is designed for study and analysis of the effects of opening shock and wind loading on the dynamics of a parachutist. The model consists of 11 rigid bodies linked together to simulate the human figure of a parachutist. Springs and dampers are used to model the joint forces and moments. The parachute forces are modelled by riser forces applied to the torso of the model. The wind loading is modelled as a profile drag force on each body of the model. The governing dynamical equations of motion for the system are coded into a computer program and they are then integrated numerically. Comparisons with experimental data on parachutist head acceleration shows good agreement between model and experiment. (Author)

A78-21713 **Aerodynamic forces exerted on an articulated human body subjected to windblast.** D. J. Schneck (Virginia Polytechnic Institute and State University, Blacksburg, Va.). (*U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.*) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 183-190. 17 refs.

A mathematical analysis is developed for evaluating the pressure distribution on an articulated body subjected to windblast. The model shows that flow separation and the appearance of stagnation points in the fluid are effects responsible for the creation of limb-dislodging forces resulting in flail injuries. Both effects are functions of the square of the velocity of the incident stream and become significant at near-sonic speeds. It is suggested that the factors inducing flow stagnation and flow separation which must be reduced include: ejection seat geometrical configuration, the pilot position at ejection, the type of clothing worn, the weight and mass of the seat relative to that of the pilot, and the speed of ejection.

S.C.S.

A78-21714 **Validation of the CALSPAN gross-motion-simulation code with actually occurring injury patterns in aircraft accidents.** J. M. Ballo, M. J. Dunne, Jr., and R. R. McMeekin (U.S. Armed Forces Institute of Pathology, Washington, D.C.). (*U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.*) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 191-195. 7 refs. DA Project 3A7-62758-A-819.

Digital simulation of aircraft-accident kinematics has heretofore been used almost exclusively as a design tool to explore structural load limits, precalculate decelerative forces at various cabin stations, and describe the effect of protective devices in the crash environment. In an effort to determine the value of digital computer simulation of fatal aircraft accidents, a fatality involving an ejection-system failure (out-of-envelope ejection) was modeled, and the injuries actually incurred were compared to those predicted; good agreement was found. The simulation of fatal aircraft accidents is advantageous because of a well-defined endpoint (death), lack of therapeutic intervention, and a static anatomic situation that can be minutely investigated. Such simulation techniques are a useful tool in the study of experimental trauma. (Author)

A78-21715 **Mathematical modeling of the head and neck response to -G/x/ impact acceleration /minimum articulation requirements/.** G. D. Frisch and C. Cooper (U.S. Navy, Naval Aerospace Medical Research Laboratory, New Orleans, La.). (*U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.*) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 196-204. 6 refs. Navy-supported research.

An analysis is presented of the dynamic response of the human head and neck to -G(x) impact acceleration. A computer simulation is used to estimate head and neck response to the deceleration profiles simulated; two head pivot locations are evaluated. The resulting information is then analyzed by a successive approximation technique. This involves removing all constraints to head and neck motion and then successively adding restraints until human data is duplicated. Results compared to calculations for an additional eight subjects showed excellent agreement. The results for one subject were further verified by a comparison of derived angular deflection values and those obtained from X-rays. S.C.S.

A78-21716 **Comprehensive, three-dimensional head-neck model for impact and high-acceleration studies.** R. L. Huston, J. C. Huston, and M. W. Harlow (Cincinnati, University, Cincinnati, Ohio; Iowa State University of Science and Technology, Ames, Iowa). (*U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.*) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 205-210. 30 refs. NSF Grant No. ENG-75-21037; Contract No. N00014-76-C-0139; Grant No. NIH-1-NS-42302.

A three-dimensional, 54-degree-of-freedom computer model of the head/neck system is presented and discussed. The model consists of nine rigid bodies representing the head and vertebrae together with a series of nonlinear springs and dampers modelling the soft tissue. The soft tissue modelling involves the discs, muscles, and ligaments. The discs are modelled as two-parameter viscoelastic solids; the muscles are also modelled as two-parameter viscoelastic solids, but only able to exert force in tension; and the ligaments are modelled as nonlinear elastic bands exerting force only in tension. Equations of motion are written for this model by using Lagrange's form of d'Alembert's principle, a virtual work type principle. Computer algorithms are written to efficiently compute the numerical coefficients of these equations. The equations are integrated numerically for a number of specific cases where experimental data are available. Results show excellent agreement between the model and the experiments. (Author)

A78-21717 **Prediction of head/neck dynamic response of selected military subjects to -G/x/ acceleration.** L. W. Schneider and B. M. Bowman (Michigan, University, Ann Arbor, Mich.). (*U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.*) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 211-223. 9 refs. Contract No. N00014-75-C-1077.

Eighteen young male subjects with NAMRL sled test experience to 15 G in -G/x/ acceleration were measured for physical characteristics of the head and neck and general body anthropometry. Measurements taken include head/neck range of motion, neck muscle stretch reflex time, neck muscle isometric strength capabilities, and seated and standard anthropometry. Data from these tests were tabulated and five subjects whose physical characteristics were most similar were selected for use in simulations. Experimental data from sled tests were obtained for the five subjects in 6- and 15-G test runs. Measurement data from the five subjects were used to establish a data set for the MVMA-2D Crash Victim Simulator and acceleration profiles for 6- and 15-G sled runs were used as input to the model. Simulation results for head angular acceleration, head angular

velocity, head angular position, head resultant acceleration, and T-1 resultant acceleration were compared with the averaged experimental curves for the five subjects. In general, excellent agreement between simulation and experimental results was obtained although some consistent differences were noted. (Author)

A78-21718 Predictive model of dynamic response of the human head/neck system to $-G(x)$ impact acceleration. D. E. Smith and W. R. Anderson (U.S. Navy, Naval Aerospace Medical Research Laboratory Detachment, New Orleans, La.). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 224-233. 23 refs. Contract No. N00014-74-C-0154.

The paper describes the mathematical framework, underlying an empirical model, that predicts human head response using only the motion present at vertebra T(1). Based on this framework, a model for $-G(x)$ impact acceleration was developed from data obtained on six volunteer subjects participating in the NAMRL impact acceleration experiments. Model performance was evaluated by comparing the errors in the predicted head responses with the normal variations observed between the responses of different subjects under identical impact acceleration. Independent sets of data were used for building and testing the model. The results of the evaluation indicate that the model will be useful in subsequent studies of human response to impact acceleration. (Author)

A78-21719 Application of the response probability density function technique to biodynamic models. R. L. Hershey (Booz-Allen Applied Research, Inc., Bethesda, Md.) and T. H. Higgins (FAA, Washington, D.C.). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 234-239. 10 refs.

A method has been developed, called the 'response probability density function technique', which is used in predicting the probability of injury in a wide range of biodynamic situations. The method, which was developed in connection with sonic boom damage prediction, utilizes the probability density function of the excitation force and the probability density function of the sensitivity of the material being acted upon. The method is especially simple to use when both these probability density functions are lognormal. Studies thus far have shown that the stresses from sonic booms, as well as the strengths of glass and mortars, are distributed lognormally. Some biodynamic processes also have lognormal distributions and are, therefore, amenable to modeling by this technique. In particular, this paper discusses the application of the response probability density function technique to the analysis of the thoracic response to air blast and the prediction of skull fracture from head impact. (Author)

A78-21720 Empirical model of intracranial pressure and head motion resulting from a vibrating seated rhesus. W. R. Anderson, R. A. Boster, and G. C. Willems (U.S. Navy, Naval Aerospace Medical Research Laboratory Detachment, New Orleans, La.). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 240-252. Navy-supported research.

A series of experiments was designed to measure the head X and Z accelerations and the intracranial pressure in the unrestrained head of a rhesus monkey. The subject was exposed to a continuum of vibration frequencies from 2 to 35 Hz and peak acceleration amplitudes of 5, 10, 20, and 40 m/square sec. The resulting data was used to build a frequency response model relating the head accelerations and pressures to the torso acceleration. The head-to-

torso relationships, based upon a single subject, were both repeatable and invariant for torso acceleration amplitudes of 10, 20, and 40 m/square second. At frequencies above 10 Hz, the model strongly suggested the presence of linear system, and the inherent advantages of superposition. The model demonstrates the validity of the experimental method, involving a slow sweep through a range of frequencies, and of the analysis procedures used. More importantly, it promises to be a useful approach to the study of human response to vibration. (Author)

A78-21721 Response of the skeletal system to helicopter-unique vibration. J. R. Gearhart (U.S. Army, Aeromedical Research Laboratory, Fort Rucker, Ala.). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 253-256. 18 refs.

An 18-month prospective skeletal system study was conducted on flying and nonflying personnel relative to chronic low-frequency vibration as experienced in helicopter flight. The aviators were initial entry students in rotary-wing training while the nonflying participants were beginning basic military training. Comparisons were made on the basis of anthropometric measurements, radiological studies, and bone mineral density changes as measured by photon absorption. The bone mineral densitometry showed no significant variation in the aviator group. A short-term 10% demineralization of the distal ulna in the nonflying group was noted immediately following the physical training. The final bone mineral density of basic training subjects returned to the initial level 18 months after the physical training. It was concluded that the helicopter aircrew members under study were exposed to levels of vibration below the threshold of vibration required to produce a measurable change in the skeletal system. (Author)

A78-21722 Determination of optimum vibroisolation systems for a sitting human operator. M. Ksiazek (Krakow, Politechnika, Krakow, Poland). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 257-261. 6 refs.

Optimum vibroisolation systems were obtained for a sitting human operator subjected to stochastic vertical vibrations. It was concluded that there exists a physically realizable optimum function which describes the desired vibroisolation system. The theory for finding an optimum vibroisolation system was developed on the basis of a specific a priori criterion, assuming random, ergodic vibrations given by power spectral densities of accelerations of the vibration base. Examples are given for human body models consisting of a mass, a linear or nonlinear spring, and a damper. (Author)

A78-21723 Model of the supine human body and its reactions to external forces. L. Vogt, H. Mertens, and H. E. Krause (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Flugmedizin, Bad Godesberg, West Germany; Wright State University, Kettering, Ohio). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 270-278. 10 refs. Bundesministerium der Verteidigung Contract No. 1-1473-V-73.

Mechanical impedance and vibration transmissibility measurements were conducted on supine humans using sinusoidal vibrations. The frequencies tested were 1-20 Hz with a constant acceleration amplitude of 0.3 G. The tests were repeated with 4.54 kg pure mass placed on each segment. Both results were used to calculate a multi-degree-of-freedom lumped parameter model. The nonlinear reactions of the body are revealed by comparing the model

parameters under 'no load' and 'load' conditions. When the results are compared with impedance measurements conducted under sustained acceleration, it becomes obvious that the thorax, due to its anatomical design, reacts differently from the remaining body parts.

(Author)

A78-21724 Mathematical model of the cardiovascular system under acceleration stress. X. J. R. Avula (Missouri-Rolla, University, Rolla, Mo.) and H. L. Oestreicher (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio). (*U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.*) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 279-286. 28 refs.

A model involving the Navier-Stokes equations for blood flow, large elastic deformation theory for the deformation of blood vessels and the left ventricle, and a baroreceptor mechanism to overcome cardiac insufficiency was employed to study the time-dependent effects of acceleration on the human cardiovascular system. A numerical example of aortic pressure, calculated on the basis of a specified deceleration profile, appears to agree in qualitative terms with measurements obtained from an experiment in which a beagle was subjected to the same deceleration.

J.M.B.

A78-21725 Nonlinear behavior of sitting humans under increasing gravity. H. Mertens (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Flugmedizin, Bad Godesberg, West Germany.) (*U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.*) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 287-298. 7 refs.

To determine the nonlinear properties of the upright sitting human body, driving-point impedance as well as the transmissibility from seat to head were determined under increased gravity on a centrifuge. Under this condition a shift of resonances to higher frequencies was observed. At the same time the transmissibility increased distinctly. To explain this behaviour with a model, a nonlinear multi-degree-of-freedom model of the upright sitting body was calculated. Its elements represent identifiable body parts. Protective measures for normal gravity conditions, as well as for sustained acceleration, were derived.

(Author)

A78-21726 Personalized, electro-kinematic, neuromuscular model of a human forearm. W. H. Boykin, Jr., H. W. Doddington (Florida, University, Gainesville, Fla.), D. B. Chaffin (Michigan University, Ann Arbor, Mich.), and R. C. Meacham (Eckert College, St. Petersburg, Fla.). (*U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.*) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 299-303. 9 refs. NSF Grant No. GK-37024X.

A78-21727 Biomechanical models for vibration feedthrough to hands and head for a semisupine pilot. H. R. Jex and R. E. Magdaleno (Systems Technology, Inc., Hawthorne, Calif.). (*U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.*) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 304-316. 32 refs. Contract No. F44620-73-C-0075.

A lumped-parameter biomechanical model has been developed for aircraft control system designers working with the advanced generation of low-altitude, high-speed, highly maneuverable military aircraft. The model was evolved through tracking experiments under conditions of three-axis vibration with sinusoidal and random waveforms and different control stick configurations. Vibration

feedthrough to hands and head is described on the assumption of a semisupine torso, sliding hips, rocking chest, bobbing head on an articulated neck, and upper arm and forearm links with grip-interface compliance.

J.M.B.

A78-21728 Conceptual stress study model. C. B. Harrah (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio). (*U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.*) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 317-320. 5 refs.

The conceptual stress study model (SSM) is basically a schematic representation of the key elements associated with the study of mechanical forces on the human operator. It has been a useful tool for systematically describing the scope and effects of vibration stress study efforts. The model structure is organized in a hierarchy of four levels established to reflect four different levels of description of human response complexity. In order of increasing complexity, these four classes of responses are biodynamic, physiological, psychophysical, and performance. The model also depicts the internal energy and/or information pathways that are likely to occur in the formation of a response to specified vibration inputs. The present utility of this model is to provide a conceptual scheme to help guide vibration study efforts. It is not a general mathematically predictive model. It could prove useful in pulling together the many-segmented modeling results achieved over the last several years to form a centralized interpretive data base.

(Author)

A78-21729 Model for human controller performance in vibration environments. W. H. Levison (Bolt Beranek and Newman, Inc., Cambridge, Mass.). (*U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.*) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 321-327. 11 refs. Contracts No. F33615-74-C-4041; No. F33615-75-C-5043; No. F33615-76-C-5015.

A model has been developed to predict biomechanical response and human controller performance as a function of vibration environment and tracking-task parameters. The model consists of three major elements: (1) a biodynamic model to predict limb and body motion resulting from platform vibration, (2) a pilot/vehicle model to predict tracking performance, and (3) an interface model to relate changes in certain pilot-related model parameters to biodynamic response. Linearity of biodynamic response mechanisms is demonstrated, and the model is shown to predict accurately the effects on tracking performance of vibration amplitude and spectrum, control gain, R.M.S. tracking input, and direction of vibration input.

(Author)

A78-21730 Recent advances in modelling the effects of roll motion on the human operator. A. M. Junker (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio) and W. H. Levison (Bolt Beranek and Newman, Inc., Cambridge, Mass.). (*U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.*) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 328-334. 13 refs.

An experiment is presented in which the effects of roll motions on human operator performance were investigated. The motion cues considered were the result of commanded vehicle motion and vehicle disturbances. An optimal control pilot-vehicle model was used in the design of the experiment and to predict system performance prior to executing the experiment. The model predictions and experimental results are compared. Of the model predictions, 78% are within 1 S.D. of the means of the experimental results. The high correlation between model predictions and system performance indicate the usefulness of the predictive model for experimental design and for prediction of pilot performance influenced by motion cues. (Author)

A78-21731 **Modelling human responses to vibration.** J. Sandover (Loughborough University of Technology, Loughborough, Leics., England). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 335-339. 8 refs.

Biodynamic measurements of human response to vibration may be nonlinear as a result of active control of the response, complex body movements, or tissue characteristics. Experiments using a random Gz stimulus were designed to explore the extent of these nonlinearities under normal conditions. The input transfer function was found to exhibit near-linearity, but transmission measures suffered from errors arising from complex body movements. The technique developed was found to be valuable for investigation of the variables affecting human response, and examples are given of the effects of body restraint and the relationship between intraabdominal pressure and input acceleration. It is argued that improved techniques and careful consideration of variables could lead to a greater acceptance of the biodynamic approach. (Author)

A78-21732 **Vision during angular oscillation - The dynamic interaction of visual and vestibular mechanisms.** A. J. Benson and G. R. Barnes (RAF, Institute of Aviation Medicine, Farnborough, Hants., England). (U.S. Air Force Aerospace Medical Research Laboratory and National Academy of Sciences - National Research Council, Symposium on Biodynamic Models and their Applications, 2nd, Dayton, Ohio, Feb. 15-17, 1977.) *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 2, p. 340-345. 31 refs.

A review is presented of the dynamic behaviour of two oculomotor control systems - the vestibulo-ocular and pursuit reflexes - responsible for the spatial and temporal stabilization of the image of an observed object on the fovea of the retina, and mathematical models adduced in which the contribution of physiological components of the systems can be identified. With angular oscillation of the head below 1.2 Hz, retinal information is used to maintain unity gain of the head/eye system, but at higher frequencies stabilization is determined primarily by vestibular inputs. When the observed target moves with the head, as in a head-mounted display, the suppression of inappropriate vestibulo-ocular responses is dependent upon the dynamic performance of the pursuit system. With such a display, impairment of visual acuity may be detected at frequencies of oscillation as low as 0.5 Hz. (Author)

A78-21733 * **Bidirectional overadaptation achieved by executing leftward or rightward head movements during unidirectional rotation.** A. Graybiel and J. Knepton (U.S. Naval Aerospace Medical Research Laboratory, Pensacola, Fla.). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 1-4. 9 refs. NASA Order No. T-9140-E; Navy Project M51,524,005-7031.

Nine college age males, all prone to motion sickness, were subjects in an experiment designed to test adaptation to motion. Subjects were placed in a slow rotation room (SRR) for varying intervals and asked to perform headward movements. Degree of adaptation to the SRR was measured in the framework of 3 categories: reduction of ataxia, reduction of oculogyral illusion, and reduction of epiphenomena, which includes symptoms of motion sickness. 'Satisfactory' adaptation was acquired and retained in 7 of the 9 subjects. Tables are presented summarizing the results. D.M.W.

A78-21734 **Relationships between ambient, cockpit, and pilot temperatures during routine air operations.** M. H. Harrison, C. Higenbottom, and R. A. Rigby (RAF, Institute of Aviation Medicine, Farnborough, Hants., England). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 5-13. 20 refs.

Thermal data obtained from aircraft flying routine sorties from RAF Germany in summer have been reduced to a form suitable for

statistical analysis by describing thermal stress in terms of a modified wet bulb globe temperature (WBGT) index, and thermal strain in terms of mean body temperature. Ambient temperature could be related to cockpit temperature, and cockpit temperature to pilot mean body temperature by linear equations of positive slope. Relationships between mean body temperature and sortie time could be represented by exponential equations. Models capable of predicting cockpit thermal stress and aircrew thermal strain given ambient temperature and sortie time have been constructed. (Author)

A78-21735 **Comparison of analysis techniques for electromyographic data.** J. C. Johnson (U.S. Army, Aeromedical Research Laboratory, Fort Rucker, Ala.). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 14-18. 5 refs.

An electromyographic (EMG) study was conducted to evaluate the effects of muscular stress in performing a variety of functions in the static environment. Specific goals of the experiment were: to develop a technique of surface electrode application which minimizes the effect of motion artifact, to compare techniques which are commonly used to analyze surface EMG data, and to determine the effect produced by indirect vibration in a well defined group of muscles. The muscular group under study was the forearm flexors in the right arm of normal men and women. A hybrid computer was used to plot EMG vibration as a function of arm load. Graphs are presented to illustrate the results. D.M.W.

A78-21736 * **Cosmic ray effects on the eyes of rats flown on Cosmos no. 782, Experiment K-007.** D. E. Philpott, R. Corbett, C. Turnbull, G. Harrison, D. Leafer, S. Black (NASA, Ames Research Center, Moffett Field, Calif.), W. Sapp (Tuskegee Institute, Tuskegee, Ala.), G. Klein (Children's Hospital, Oakland, Calif.), and L. F. Savik (Ministerstvo Zdravookhraneniia SSSR, Institut Mediko-Biologicheskikh Problem, Moscow, USSR). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 19-28. 25 refs. Grant No. NCA2-OR810-701.

A study was undertaken to determine if, and to what extent, pathological damage results from high-energy particles (HZE) transverse the eye. Light flashes experienced by space travellers indicate that HZE do indeed pass through and activate the retina, but whether actual biological damage occurs has not been investigated thoroughly. Thus, autopsies were performed on the eyes of rats which has been flown in Cosmos 782 satellite for 19.5 days. Comparisons with a control sample subjected to 1000 rads of Ar and Ne radiation show that pathological damage, when it occurs, affects the nucleus of the retina; simple light flashes are not thought to indicate a pathology, and result from activation of (but not damage to) the retina's outer segments. D.M.W.

A78-21737 **Coriolis cross-coupling effects - Disorienting and nauseogenic or not.** F. E. Guedry, Jr. (U.S. Naval Aerospace Medical Research Laboratory, Pensacola, Fla.) and A. J. Benson (RAF, Institute of Aviation Medicine, Farnborough, Hants., England). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 29-35. 11 refs.

Nausea and disorientation are sometimes produced by head movements during turning maneuvers in aircraft. These responses are usually attributed to Coriolis cross-coupling stimulation of the vestibular system, although it has been indicated recently that many turning maneuvers of aircraft have insufficient angular velocity to generate such effects. The purpose of the present study was to further distinguish conditions in which Coriolis cross-coupling effects are disorienting and nauseogenic from conditions in which they are neither. (Author)

A78-21738 **Visual counteraction of nauseogenic and disorienting effects of some whole-body motions - A proposed mechanism.** F. E. Guedry, Jr. (U.S. Naval Aerospace Medical Research Laboratory, Pensacola, Fla.). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 36-41. 17 refs.

It has been indicated that the nauseogenic and disorienting effects of several kinds of provocative motion stimuli can be ameliorated by visual reference to the earth. The purpose of the present experiment is to investigate a hypothesis concerning the mechanism of this beneficial effect. The results demonstrate that the aftereffects of large-field optokinetic stimulation can nullify the nauseogenic and disorienting effects of Coriolis cross-coupled vestibular stimuli. It is hypothesized that large-field optokinetic stimulation in a particular head plane modifies activity in the vestibular nuclei as though the semicircular canals in that plane had been stimulated. A previous study illustrated that such semicircular canal stimulation would completely nullify the disturbing and disorienting effects of Coriolis cross-coupled stimulation according to theoretical expectations. The results provide inferential support for the hypothesis and suggest that predictability of disorientation and nauseogenic disturbance is reasonably well handled by current theory when the conditions of motion are fairly well specified. (Author)

A78-21739 Radiobiological experiment aboard the biosatellite Cosmos-690. O. G. Gazenko, B. A. Adamovich, Iu. G. Grigor'ev, Iu. P. Druzhinin, E. A. Il'in, and V. I. Popov (Ministerstvo Zdravookhraneniia SSSR, Institut Mediko-Biologicheskikh Problem, Moscow, USSR). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 42-46.

In 1974, the USSR launched the biosatellite Cosmos-690 equipped with a gamma-irradiation unit that carried 35 rats. On the 10th flight day, the rats were exposed to radiation at doses of 220 or 800 rads. During the subsequent 10 days, radiation injury developed in a space environment. Similar ground-based experiments were carried out to simulate space flight environment effects. The results obtained were studied on a comparative basis. The conclusion is made that effects of a short-term space flight, as long as 20 days, do not essentially modify the radiobiological effect. (Author)

A78-21740 Vitamins limiting for growth of subjects fed a normal diet under hyperbaric He-O₂ conditions. C. A. Zogg, S. J. Brumleve, B. DeBoer, and T. K. Akers (North Dakota, University, Grand Forks, N. Dak.). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 47-52. 14 refs. Contract No. N00014-76-C-0219.

A growth study was conducted of rats continuously exposed for 4 weeks to ambient air, 1 ATA He-O₂, or 11 ATA He-O₂ conditions and fed one of 16 diets. The diets were the standard diet alone (adequate according to National Research Council standards); the standard diet with additional casein (50%), fat (25%), and all vitamins (25%); or the standard diet with all vitamins (25%), or all vitamins increased (25%) except one, which was supplied at the standard level. The standard diet was inadequate to support a normal rate of growth when fed under 11 ATA He-O₂ conditions. Supplemental casein, fat, and vitamins or all vitamins alone adequately provided nutrients necessary for a normal rate of growth by hyperbaric exposed rats. The standard levels of thiamine, pantothenic acid, biotin, and vitamin K were inadequate and the standard levels of niacin, and vitamins A, D, and E were marginal in supporting growth when fed under hyperbaric conditions. (Author)

A78-21741 Increased secretion of growth hormone, prolactin, antidiuretic hormone, and cortisol induced by the stress of motion sickness. T. Eversmann, G. Ulbrecht (Bundesministerium der Verteidigung, Flugmedizinisches Institut, Fürstfeldbruck, West Germany), M. Gottsmann, E. Uhlich, K. von Werder, and P. C. Scriba (München, Universität, Munich, West Germany). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 53-57. 25 refs.

A78-21742 Increased urinary excretion of triiodothyronine /T₃/ and thyroxine /T₄/ and decreased serum thyrotropic hormone /TSH/ induced by motion sickness. J. Habermann, F. Erhardt, M. Gottsmann, P. C. Scriba (München, Universität, Munich, West Germany), T. Eversmann, and G. Ulbrecht (Bundesministerium der Verteidigung, Flugmedizinisches Institut, Fürstfeldbruck, West

Germany). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 58-61. 14 refs.

A78-21743 Effects of 6 hours hypoxic and cold exposure on urinary electrolyte and catecholamine excretion. T. Purshottam, M. L. Pahwa, and H. D. Brahmachari (Defence Institute of Physiology and Allied Sciences, Delhi; Defence Research and Development Establishment, Gwalior, India). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 62-65. 31 refs.

A78-21744 * Alterations in erythrocyte survival parameters in rats after 19.5 days aboard Cosmos 782. H. A. Leon (NASA, Ames Research Center, Biomedical Research Div., Moffett Field, Calif.), L. V. Serova (Ministerstvo Zdravookhraneniia SSSR, Institut Mediko-Biologicheskikh Problem, Moscow, USSR), J. Cummins (Northrop Services, Inc., Moffett Field, Calif.), and S. A. Landaw (U.S. Veterans Administration Hospital, Syracuse, N.Y.). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 66-69. 21 refs.

Rats were subjected to 19.5 days of weightless space flight aboard the Soviet biosatellite, Cosmos 782. Based on the output of CO-14, survival parameters of a cohort of erythrocytes labeled 15.5 days preflight were evaluated upon return from orbit. These were compared to vivarium control rats injected at the same time. Statistical evaluation indicates that all survival factors were altered by the space flight. The mean potential lifespan, which was 63.0 days in the control rats, was decreased to 59.0 days in the flight rats, and random hemolysis was increased three-fold in the flight rats. The measured size of the cohort was decreased, lending further support to the idea that hemolysis was accelerated during some portion of the flight. A number of factors that might be contributory to these changes are discussed, including forces associated with launch and reentry, atmospheric and environmental parameters, dietary factors, radiation, and weightlessness. (Author)

A78-21745 Rat lung hyper-reactivity to stress. D. L. Beckman (East Carolina University, Greenville, N.C.). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 70-72. 23 refs.

Rats were compared with other laboratory mammals in terms of reactivity to CNS traumatization either mechanical or hyperbaric. As indicated by lung weight/body weight ratios and by gross appearance, the rats were more dramatically affected than the other mammals studied. This reactivity was ameliorated by the prior administration of various sympathetic blocking agents. D.M.W.

A78-21746 Low atmospheric pressure effects on wearing soft contact lenses. W. G. Eng, J. L. Rasco, and J. A. Marano (U.S. Navy, Eye Clinic, Alameda, Calif.). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 73-75. 6 refs.

The majority of all research in the field of contact lenses has taken place in a normal, ground-level environment. The purpose of this study was to determine if any changes occurred in wearing hydrophilic soft lenses under conditions of low atmospheric pressures. The effects on visual acuity, refraction, keratometry, and biomicroscopy were investigated with eight naval volunteers while wearing soft contact lenses at simulated altitudes up to 30,000 ft (9144 m) in an aviation hypobaric chamber. The results indicated that the low atmospheric pressure at high altitude in itself did not affect the fit of soft contact lenses. (Author)

A78-21747 Psychogenic G-force intolerance revisited. T. J. Wachs and C. J. G. Perry (USAF, Medical Center, Lackland AFB, Tex.). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 76, 77.

Human tolerance to G-force depends on both physiological and psychological variables. Three individual case histories are presented, outlining causes of psychological unfitness for military flying. In all cases, lack of motivation in regard to the flight training is said to be the crucial factor in G-stress intolerance. D.M.W.

A78-21748 Hypertension in the civilian flying population - Significant or not. M. A. Berry and R. L. Wick, Jr. (Ohio State University, Columbus, Ohio). *Aviation, Space, and Environmental Medicine*, vol. 49, Jan. 1978, Section 1, p. 78-80. 10 refs.

The extent of hypertension within the civilian pilot population of the U.S. is evaluated. Data pertaining to the current prevalence of hypertension in the general population is compared to similar data on the pilot population. Though there are some limitations to a direct comparison of these data, the pilot population is found to be significantly different from the general population. The prevalence of hypertension in the general population was 30 times greater than for pilots. Though the overall prevalence in pilots was small, hypertension is still considered a significant illness in this group. (Author)

A78-21874 * Origins of prokaryotes, eukaryotes, mitochondria, and chloroplasts. R. M. Schwartz (National Biomedical Research Foundation, Washington, D.C.) and M. O. Dayhoff (Georgetown University; National Biomedical Research Foundation, Washington, D.C.). *Science*, vol. 199, Jan. 27, 1978, p. 395-403. 58 refs. Contract No. NASw-3019; Grants No. NIH-GM-08710; No. NIH-RR-05681.

A computer branching model is used to analyze cellular evolution. Attention is given to certain key amino acids and nucleotide residues (ferredoxin, 5s ribosomal RNA, and c-type cytochromes) because of their commonality over a wide variety of cell types. Each amino acid or nucleotide residue is a sequence in an inherited biological trait; and the branching method is employed to align sequences so that changes reflect substitution of one residue for another. Based on the computer analysis, the symbiotic theory of cellular evolution is considered the most probable. This theory holds that organelles, e.g., mitochondria and chloroplasts invaded larger bodies, e.g., bacteria, and combined functions to form eucaryotic cells. D.M.W.

A78-21876 International Union of Radio Science, Annual Meeting, University of Massachusetts, Amherst, Mass., October 11-15, 1976, Proceedings. Edited by D. R. Justesen (U.S. Veterans Administration Hospital, Kansas City, Mo.; Kansas University, Kansas City, Kan.) and A. W. Guy (Washington University, Seattle, Wash.). *Radio Science*, vol. 12, Nov.-Dec. 1977, Supplement. 282 p.

The measurement of microwave radiation absorbed by biological systems is considered along with aspects of focal hyperthermia as induced by RF radiation of simulacra with embedded tumors and as induced by EM fields in a model of a human body, the deposition of electromagnetic energy in animals and in models of man with and without grounding and reflector effects, radio-frequency radiation levels in urban areas, a radio-frequency radiation dosimetry handbook, and a comparison of the average specific absorption rate in the ellipsoidal conductor and dielectric models of humans and monkeys at radio frequencies. Attention is also given to drug-induced ectothermia in small mammals, a dual-beam TEM applicator for direct-contact heating of dielectrically encapsulated malignant mouse tumor, a method for exposing cell cultures to electromagnetic fields under controlled conditions of temperature and field strength, radiators for microwave biological effects research, a microwave exposure system for primates, a comparative heating-pattern study of direct-contact applicators in microwave diathermy, new artifact-free electrodes for the recording of biological potentials in strong electromagnetic fields, and the effect of repeated microwave exposure on neonatal rats. G.R.

A78-21877 Measurement of microwave radiation absorbed by biological systems. I - Analysis of heating and cooling data. J. W. Allis, C. F. Blackman, M. L. Fromme, and S. G. Benane (U.S. Environmental Protection Agency, Health Effects Research Laboratory, Research Triangle Park, N.C.). (*International Union of Radio Science, Annual Meeting, Amherst, Mass., Oct. 11-15, 1976.*) *Radio Science*, vol. 12, Nov.-Dec. 1977, Supplement, p. 1-8. 26 refs.

In order for meaningful comparisons to be made between experiments from different laboratories, reliable dosimetry is needed for biological systems exposed to microwave radiation. We present an improved analytical method for determining energy absorption which uses heating and cooling curves. The method is demonstrated for in vitro samples that were exposed to microwave radiation in two different exposure systems. Advantages and disadvantages of the method, as well as practical considerations, are discussed. (Author)

A78-21878 Measurement of microwave radiation absorbed by biological systems. II - Analysis by Dewar-flask calorimetry. C. F. Blackman and J. A. Black (U.S. Environmental Protection Agency, Health Effects Research Laboratory, Research Triangle Park, N.C.). (*International Union of Radio Science, Annual Meeting, Amherst, Mass., Oct. 11-15, 1976.*) *Radio Science*, vol. 12, Nov.-Dec. 1977, Supplement, p. 9-14. 11 refs.

Free-field power density has long been used as an index of energy dosing in studies of biological effects of microwave radiation. However, this method of quantifying dose can lead to considerable error if it is used as an index of the rate of energy actually being absorbed by a specimen, because the relative absorption cross sections of different specimens may vary greatly. The integral of absorbed energy is a more meaningful measure of exposure; it can be accomplished by using such sophisticated equipment as twin-well calorimeters, or by using the cruder system of saline-filled phantoms. This paper describes a calorimetric system for the measurement of absorbed energy in laboratory animals and in in vitro samples that can be assembled from such common laboratory equipment as Dewar flasks, magnetic stirrers, foamed polystyrene, and an accurate temperature measuring device. Measurements of absorbed energy by this system for a standard tissue-culture flask are compared to values obtained by electrical measurements, by direct temperature measurements, and by heating and cooling curves. Also, application of the system to measurements of dose in experimental animals is demonstrated. (Author)

A78-21879 Theoretical calculation of frequencies and thresholds of microwave-induced auditory signals. J. C. Lin (Wayne State University, Detroit, Mich.). (*International Union of Radio Science, Annual Meeting, Amherst, Mass., Oct. 11-15, 1976.*) *Radio Science*, vol. 12, Nov.-Dec. 1977, Supplement, p. 237-242. 16 refs. NSF Grant No. ENG-75-15227.

Previously developed thermoelastic models of microwave-induced auditory sensations are applied to calculate the frequency and amplitude of the acoustic signals that are generated in human beings and laboratory animals. Graphs of computed displacement and pressure as a function of time are presented for several species. (Author)

A78-21905 # Tracking of a programmed motion by a manipulator (K zadache ob otslezhivanií manipulatorom programmogo dvizheniia). D. K. Voronetskaia and V. N. Fomin. *Leningradskii Universitet, Vestnik, Matematika, Mekhanika, Astronomiia*, July 1977, p. 132-136. In Russian.

The problem of synthesizing an adaptive control for a manipulator acting under conditions where not all the manipulator parameters are known is considered. An adaptive control algorithm is proposed that does not involve measuring the second derivatives with respect to time of the manipulator state variables. The algorithm ensures a tracking error smaller than any preassigned value. P.T.H.

A78-22073 # Effect of electrical stimulation of posterior hypothalamus structures on the acetylcholinesterase activity of the cortical motor zone in health and under the action of pharmacological agents (Diia elektrichnogo podraznennia struktur zadn'ogo viddilu gipotalamusa na atsetilkholinesteraznu aktivnist' motornoi dilianki kori v normi ta pri farmakologichnikh vplivakh). O. F. Makarchenko, B. A. Roitrub, R. S. Zlatin, and T. M. Ples'ka (Akademiia Nauk Ukrain'skoi RSR, Institut Fiziologii, Kiev, Ukrainian SSR). *Fiziologichnii Zhurnal*, vol. 23, Sept.-Oct. 1977, p. 591-598. 36 refs. In Ukrainian.

A78-22074 # Effect of constant magnetic field on resting potential, ionic conductivity and neuromuscular transmission in smooth muscles (Vpliv postoinogo magnitnogo polia na potentsial spokoju, ionnu providnist' ta nervovo-m'iazovu peredachu v gladkikh m'iazakh). P. G. Bogach and T. L. Davidov's'ka (Kiivs'kii Derzhavnyi Universitet, Kiev, Ukrainian SSR). *Fiziologichnii Zhurnal*, vol. 23, Sept.-Oct. 1977, p. 622-626. 16 refs. In Ukrainian.

A78-22075 # The hypothalamus and the visual system (Gipotalamus i zorova sistema). O. F. Makarchenko, R. R. Velika, and V. M. Il'in (Akademiia Nauk Ukrain's'koi RSR, Institut Fiziologii, Kiev, Ukrainian SSR). *Fiziologichnii Zhurnal*, vol. 23, Sept.-Oct. 1977, p. 688-698. 126 refs. In Ukrainian.

This review article gives a brief mention of some of the goals, methods, and conclusions of a larger number of studies on the relations between the hypothalamus and visual activity. Numerous EEG studies are mentioned. P.T.H.

A78-22494 * Effect of carbon monoxide and nitrogen dioxide on ICR mice. C. J. Hilado and H. J. Cumming (San Francisco, University, San Francisco, Calif.). *Journal of Combustion Toxicology*, vol. 4, Nov. 1977, p. 523-532. 13 refs. Grant No. NSG-2039.

Times to incapacitation and death and LC(50) values were determined for male ICR-mice-exposed to different concentration of carbon monoxide for 30 min and of nitrogen dioxide for 10 min in a 4.2 liter hemispherical chamber. The data indicate that ICR mice are more resistant to these two toxicants than Swiss albino mice. The carbon monoxide LC(50) for a 30-min exposure was about 8,000 ppm for ICR mice compared to 3,570 ppm for Swiss albino mice. The nitrogen dioxide LC(50) for a 10-min exposure was above 2,000 ppm for ICR mice compared to about 1,000 ppm for Swiss albino mice. (Author)

A78-22496 * Studies with the USF/NASA toxicity screening test method - Oxygen concentrations with various test conditions. C. J. Hilado, H. J. Cumming, and A. N. Solis (San Francisco, University, San Francisco, Calif.). *Journal of Combustion Toxicology*, vol. 4, Nov. 1977, p. 556-562. 10 refs. Grant No. NSG-2039.

Continuing efforts to increase the versatility of the USF/NASA toxicity screening test method have included the use of different test conditions in order to simulate various fire environments. The use of air flow at flow rates of 16 to 48 ml/sec maintains oxygen concentrations above 19 percent throughout the 30 min exposure period, compared to above 16 percent without forced air flow. These levels of oxygen are well within the tolerance range of mice, and approach the oxygen levels found in many real fire situations. Proposed minimum oxygen levels based on experience with rats are unduly restrictive on the use of other species such as mice, and tend to eliminate the cost savings which may more than justify the selection of mice. (Author)

A78-22498 # Characteristics of heat-sensitive neurons in the posterior hypothalamus (Kharakteristika termochuvstvitel'nykh neuronov zadnego gipotalamusa). D. Kushakov (Akademiia Nauk SSSR, Institut Fiziologii, Leningrad, USSR). *Fiziologicheskii Zhurnal SSSR*, vol. 63, Sept. 1977, p. 1261-1267. 19 refs. In Russian.

Experiments were conducted on unanesthetized rabbits (2.5-3.5 kg) to study changes in the firing rate of 260 neurons of the posterior hypothalamus under thermally neutral and varying temperatures of the hypothalamus. It is shown that for a local increase (0.6-1.5 C) or decrease (0.6-2 C) in the temperature of the posterior hypothalamus, there are about 28% reactant neurons, and most of them affect the firing rate when reaching a brain temperature specific to each neuron. 45 heat-sensitive and 28 cold-sensitive neurons were discriminated. The results suggest that the basic function of the posterior hypothalamus in thermoregulation consists in integration of temperature signals reaching the thermoregulation center from different heat-sensitive structures. S.D.

A78-22499 # Influence of local increase in the temperature of the anterior hypothalamus on the bioelectrical activity of the brain (Vlianie lokal'nogo povysheniia temperatury perednegeipotala-

micheskoi oblasti na bioelektricheskuiu aktivnost' mozga). I. K. Iaichnikov (Akademiia Meditsinskikh Nauk SSSR, Leningrad, USSR). *Fiziologicheskii Zhurnal SSSR*, vol. 63, Sept. 1977, p. 1268-1274. 9 refs. In Russian.

A78-22500 # Evaluating the role of sensory innervation of extraocular muscles in the habituation of vestibulo-oculomotor responses (K otsenke roli chuvstvitel'noi innervatsii ekstraokuliarnykh myshys v privykanii vestibulo-glazodvigatel'nykh reaktsii). G. I. Gorgiladze. *Fiziologicheskii Zhurnal SSSR*, vol. 63, Sept. 1977, p. 1275-1281. 20 refs. In Russian.

A78-22838 The interaction of control gain and vibration with continuous manual control performance. C. H. Lewis and M. J. Griffin (Southampton, University, Southampton, England). *Journal of Sound and Vibration*, vol. 55, Dec. 22, 1977, p. 553-562. 10 refs.

The interaction of the effects of control gain and 4 Hz vertical (z-axis), whole-body vibration at 0.75 m/sq sec rms on human operator performance in a simple manual tracking system was investigated with four different controls. The controls were isotonic (displacement) and isometric (force) joysticks and knobs. Performance analysis includes calculation of closed-loop human operator transfer functions; components of error correlated with the tracking input and vibration and operator generated noise. The optimum control gains for minimizing tracking error under vibration were found to be lower than in static conditions due to increases in vibration-correlated error and operator-generated noise, which both tend to be proportional to control gain. (Author)

A78-23474 * Sulfate reduction and methanogenesis in marine sediments. R. S. Oremland (NASA, Ames Research Center, Planetary Biology Div., Moffett Field, Calif.; Miami, University, Rosenstiel School of Marine and Atmospheric Science, Miami, Fla.) and B. F. Taylor (Miami, University, Rosenstiel School of Marine and Atmospheric Science, Miami, Fla.). *Geochimica et Cosmochimica Acta*, vol. 42, Feb. 1978, p. 209-214. 34 refs. Research supported by the Richard G. Bader Memorial Student Research Fund; NSF Grants No. GA-41135; No. OCE-74-01986.

Methanogenesis and sulfate-reduction were followed in laboratory incubations of sediments taken from tropical seagrass beds. Methanogenesis and sulfate-reduction occurred simultaneously in sediments incubated under N₂, thereby indicating that the two processes are not mutually exclusive. Sediments incubated under an atmosphere of H₂ developed negative pressures due to the oxidation of H₂ by sulfate-respiring bacteria. H₂ also stimulated methanogenesis, but methanogenic bacteria could not compete for H₂ with the sulfate-respiring bacteria. (Author)

A78-23498 # Physics of the nerve impulse (Fizika nervnogo impul'sa). V. S. Markin, V. F. Pastushenko, and Iu. A. Chizmadzhev (Akademiia Nauk SSSR, Institut Elektrokhemii, Moscow, USSR). *Uspekhi Fizicheskikh Nauk*, vol. 123, Oct. 1977, p. 289-332. 68 refs. In Russian.

Early studies of the physical mechanism of nerve-impulse generation and propagation are reviewed. The properties and structure of neurons, especially their electrical characteristics, are described, and a phenomenological picture of excitability is provided. Ion transport across biological membranes is examined in detail along with various models of such transport, particularly transport across two-layer lipid-containing membranes. Basic models of transport mechanisms are summarized, the molecular basis of the transport process is analyzed, and experimental data concerning the ion channels in membranes are presented. The theory of single-row ion transport is outlined, and possible physical mechanisms governing the electric-field dependence of ion-channel conductivity are considered. Impulse propagation through nerve fibers is investigated, with attention given to the velocity and shape of impulses, impulse propagation through inhomogeneous fibers, and impulse interaction. F.G.M.

A78-23601 Relationship between maximal oxygen uptake and left ventricular function in exercise. L. A. Wolfe, D. A. Cunningham, G. M. Davis, and H. Rosenfeld (Western Ontario, University, London, Canada). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 44, Jan. 1978, p. 44-79. 34 refs. Research supported by the Ontario Department of Health.

A78-23602 Reliability of noninvasive methods for measuring cardiac function in exercise. L. A. Wolfe, D. A. Cunningham, G. M. Davis, and P. A. Rechnitzer (Western Ontario, University, London, Canada). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 44, Jan. 1978, p. 55-58. 30 refs. Research supported by the Ontario Department of Health.

A stress test protocol combining the recording of left ventricular systolic time intervals (STIs) with simultaneous determination of cardiac output by CO₂ rebreathing (indirect Fick method) and arterial blood pressure by auscultation was administered to 20 male volunteers. The objective was to evaluate the test-retest reliability (Pearson *r*) and reproducibility (paired *t*-test) of the protocol. The subjects exercised on a constant work load bicycle ergometer at three submaximal work loads in terms of heart rate: 79-113, 92-133, and 125-162 beats/min. The findings support the hypothesis that externally recorded STIs, indirect-Fick cardiac output, and auscultatory blood pressure can be reliably determined within the same stress test. Combined application of these methods makes it possible to calculate the mean systolic ejection rate as a measure of left ventricular performance. S.D.

A78-23603 Intravascular volume and tonicity as factors in the regulation of body temperature. M. H. Harrison, R. J. Edwards, and P. A. Fennessy (RAF, Institute of Aviation Medicine, Farnborough, Hants., England). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 44, Jan. 1978, p. 69-75. 33 refs.

Experiments were conducted on four male subjects (24-32 yr, 56-79 kg) in order to distinguish between the effects on physiological responses to exercise and heat stress of reduced intravascular volume and increased intravascular tonicity. The latter was reduced by replacing sweat losses during heat exposure with distilled water, or increased either by failing to replace sweat losses or by replacing losses with 1% saline solution. Analyses of variance were performed using the combined data from the four subjects to determine the effect of the three experimental conditions (dehydration, water replacement, and saline replacement) on body temperature, blood volume variation, plasma electrolyte concentrations, and plasma osmolality. The results suggest that the effects of reduced intravascular volume and increased intravascular tonicity on physical work capacity may be distinguished by the adverse effect of the former on the cardiovascular system and of the latter on the thermoregulatory system. S.D.

A78-23604 Transient O₂ uptake response at the onset of exercise. J. M. Hagberg, F. J. Nagle, and J. L. Carlson (Wisconsin, University, Madison, Wis.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 44, Jan. 1978, p. 90-92. 17 refs.

A78-23648 Time course of the cerebral circulatory response to metabolic depression. N. P. Keaney, D. G. McDowall, V. W. A. Pickerodt, J. M. Turner, J. R. Lane, Y. Okuda, V. D. Deshmukh, and N. J. Coroneos (Leeds University, Leeds, England). *American Journal of Physiology*, vol. 234, Jan. 1978, p. H74-H79. 36 refs. Research supported by the Medical Research Council, Glaxo Laboratories, and United Leeds Hospitals.

Experiments were carried out on baboons (7.9-12.2 kg) anesthetized with halothane-nitrous oxide-oxygen in order to investigate the following: (1) the time course of the cerebral circulatory response to intravenous Althesin, known as a steroid anesthetic agent

which causes major reductions in cerebral electrical activity, cerebral oxygen uptake, and cerebral blood flow with only moderate alterations of blood pressure; (2) the influence of acute cervical sympathectomy and alpha-adrenergic receptor blockade on this time course; and (3) the effect of intracarotid Althesin on internal carotid vascular resistance and on EEG. The results point to a very rapid cerebral circulatory response which is unaffected by acute surgical sympathectomy and alpha-adrenergic receptor blockade. S.D.

A78-23649 Fast, rate-sensitive corticosteroid negative feedback during stress. M. Kaneko and T. Hiroshige (Hokkaido University, Sapporo, Japan). *American Journal of Physiology*, vol. 234, Jan. 1978, p. R39-R45. 18 refs.

Anesthetized female rats (170-220 g) were tested in order to evaluate the characteristics of the fast rate-sensitive negative-feedback regulation of adrenocorticotropin (ACTH) secretion during a stress action induced by intravenous histamine and laparotomy plus traction. Corticosterone solutions of different concentrations were infused to obtain various levels of plasma corticosterone. It is shown that there are two types of negative-feedback inhibition of stress-induced activation of ACTH secretion: (1) fast rate-sensitive inhibition; and (2) delayed proportional feedback inhibition. A mathematical model describing the effects of corticosteroid feedback during an initial exposure to stress is proposed, which is shown to be in good agreement with experimental findings. S.D.

A78-23650 Site of fast, rate-sensitive feedback inhibition of adrenocorticotropin secretion during stress. M. Kaneko and T. Hiroshige (Hokkaido University, Sapporo, Japan). *American Journal of Physiology*, vol. 234, Jan. 1978, p. R46-R51. 28 refs.

A78-23848 Search through a sequentially presented visual display. J. E. Hoffman (Delaware, University, Newark, Del.). *Perception and Psychophysics*, vol. 23, no. 1, Jan. 1978, p. 1-11. 24 refs. Grant No. NIH-MH-27110.

Several paradoxes in the visual information processing literature are reviewed. Two experiments utilizing a sequential presentation technique suggested a two-stage model of visual search in which a parallel initial stage guides the operation of a slower serial discrimination stage. A computer simulation provided a good quantitative fit to the results of both experiments. The two-stage model shows how the paradoxes may be resolved as well as providing a framework for integrating results from visual search and spatial selective attention research. (Author)

A78-23849 Temporal summation in human vision - Simple reaction time measurements. T. Ueno (Osaka University, Osaka, Japan). *Perception and Psychophysics*, vol. 23, no. 1, Jan. 1978, p. 43-50. 26 refs.

Simple reaction time (RT) was measured as a function of stimulus intensity for a brief light pulse (1 msec) and a long one (300 msec). Target size, retinal position, and adapting luminance of the stimulus were varied parametrically, and the luminance value required to produce a RT of 50 msec greater than the asymptotic RT was calculated to obtain the critical duration or limit of time-intensity reciprocity. It was found that: the critical duration, even at the fovea, tends to increase with decreasing target size; the critical duration is shortest at the fovea and increases sharply with distance from the fovea; and as the adapting luminance increases, the critical duration decreases. These findings indicate that the RT technique is a sensitive measure for the stimulus conditions explored. (Author)

A78-23850 The effect of varying linear perspective, movement parallax, and speed of rotation on perceived oscillation of two-dimensional trapezoidal stimuli. J. H. Braden (Fairleigh Dickinson University, Teaneck, N.J.). *Perception and Psychophysics*, vol. 23, no. 1, Jan. 1978, p. 51-57. 28 refs. Grant No. NIH-501-EY-00391; Contract No. N00014-67-A-0108-0009.

Two experiments were undertaken to assess the effect of monocular movement parallax in producing oscillation of a trapezoidal window. In the first experiment, linear perspective was varied

by changing the length of the vertical sides of the stimuli. In the second, the speed of rotation of the same stimuli was varied under polar and parallel projection conditions. Subject reactions indicate that vertical cues were used as references, and that the number of perceived oscillations decreased with increasing rotation speed.

D.M.W.

A78-23854 The mathematics of computer controlled manipulators. R. Paul (Purdue University, West Lafayette, Ind.). In: Joint Automatic Control Conference, San Francisco, Calif., June 22-24, 1977, Proceedings. Volume 1. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 124-131. 26 refs.

A consistent approach to the mathematics of computer controlled manipulators has evolved based on homogeneous transformations. These transformations relate joint coordinates to cartesian coordinates of the end effector. Various forms of motion control can be consistently developed in base coordinates, hand coordinates and joint coordinates using this method. Differential motion and manipulator dynamics have also been formulated by this approach. The homogeneous transformation, used in computer graphics and computer vision, forms the natural variable for manipulation. (Author)

A78-23855 Robot and manipulator control by exteroceptive sensors. D. E. Whitney, P. C. Watson, S. H. Drake, and S. N. Simunovic (Charles Stark Draper Laboratory, Inc., Cambridge, Mass.). In: Joint Automatic Control Conference, San Francisco, Calif., June 22-24, 1977, Proceedings. Volume 1. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 155-163. 18 refs. NSF Grant No. ATA-74-18173-A01.

The use of sensors to monitor or control a process is discussed in the context of control and utilization of computer controlled robots or manipulators under manual or computer-aided control. A robot or manipulator system must interact with an environment, grasp objects, assemble them, obtain and use tools, accept control commands, and report its state. Aspects of continuous and discrete force-touch sensing are considered, taking into account the use of several scalar binary sensors in manipulation, force vector sensing, the problem of putting a pin in a chamfered hole, the straightening out of a pin which is slightly cocked inside a hole, and techniques for accomplishing insertions in the case of large errors without a use of search methods. Methods of obtaining force vector information are considered along with some of the hardware tradeoffs and design philosophy of force sensors. G.R.

A78-23881 A prototype system for automated interpretation of vectorcardiograms. D. E. Gustafson (Scientific Systems, Inc., Cambridge, Mass.), A. S. Willsky, S. K. Mitter, A. Akant, J.-Y. Wang, P. Doerschuk (MIT, Cambridge, Mass.), M. E. Womble, M. C. Lancaster, and J. H. Triebwasser (USAF, School of Aerospace Medicine, San Antonio, Tex.). In: Joint Automatic Control Conference, San Francisco, Calif., June 22-24, 1977, Proceedings. Volume 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 776-781. 6 refs.

A new approach to computer interpretation of vectorcardiograms (VCGs) has been developed using tools from the theory of statistical signal analysis. The system consists of a number of program modules, including a preprocessor, waveform detector, rhythm analyzer, waveform morphology feature extractor and pattern recognizer. A prototype system has been developed, implemented and tested and is presently operational at the USAF School of Aerospace Medicine. (Author)

A78-23882 Biped stability considerations with vestibular models. H. Hemami, F. C. Weimer, C. S. Robinson, C. W. Stockwell (Ohio State University, Columbus, Ohio), and V. S. Cvetkovic (Institut za Automatizaciju i Telekomunikaciju, Belgrade, Yugoslavia). In: Joint Automatic Control Conference, San Francisco,

Calif., June 22-24, 1977, Proceedings. Volume 2.

New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 796-803. 8 refs. Research supported by the Deafness Research Foundation; NSF Grant No. ENG-74-21164.

Recent experimental work has resulted in certain models for the semicircular canals and otoliths. The accuracy and adequacy of these models are analyzed here by incorporating them in stability studies of biped robots - one-degree and two-degree-of-freedom inverted pendulums. It is shown that a variety of feedback signals can stabilize biped models of these types. Additional information could limit the choice of such signals. (Author)

A78-23904 Efficient digitization methods for electrocardiograms. D. L. Cohn and J. L. Melsa (Notre Dame, University, Notre Dame, Ind.). In: Joint Automatic Control Conference, San Francisco, Calif., June 22-24, 1977, Proceedings. Volume 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 1386-1391. 12 refs.

This paper describes two improved methods of digitizing electrocardiograms. The methods reduce the number of bits required to represent an ECG while preserving the essential information. In particular, the resulting signal is compatible with automatic analysis techniques. The class of methods to be discussed were initially developed for digitizing speech. They exploit the statistical character of the waveform to reduce the number of bits by a factor of 4 or 5 over conventional digitization methods. This reduction is especially important when ECGs are collected remotely and transmitted to a central computer for automatic analysis, and when they are stored in a medical data bank. (Author)

A78-23997 An application of pattern recognition to echocardiography. D. E. Raeside and W.-K. Chu (Oklahoma, University, Oklahoma City, Okla.). *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SMC-8, Feb. 1978, p. 81-86. 15 refs.

Pattern classification methodology has been applied to echocardiography. Utilizing discriminative features generated by Fourier analysis, anterior mitral leaflet waveforms associated with the normal, mitral stenosis, mitral valve prolapse, and idiopathic hypertrophic subaortic stenosis cardiac conditions have been classified in a manner which is unambiguous and which lends itself easily to present day automated technology. (Author)

A78-23999 * Perseveration effects in detection tasks with correlated decision intervals. E. G. Gai (MIT; Charles Stark Draper Laboratory, Inc., Cambridge, Mass.) and R. E. Curry (NASA, Ames Research Center, Moffett Field, Calif.; MIT, Cambridge, Mass.). *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SMC-8, Feb. 1978, p. 93-100. 13 refs. Grant No. NGR-22-009-733.

An investigation of the behavior of the human decisionmaker is described for a task related to the problem of a pilot using a traffic situation display to avoid collisions. This sequential signal detection task is characterized by highly correlated signals with time varying strength. Experimental results are presented and the behavior of the observers is analyzed using the theory of Markov processes and classical signal detection theory. Mathematical models are developed which describe the main result of the experiment: that correlation in sequential signals induced perseveration in the observer response and a strong tendency to repeat their previous decision, even when they were wrong. (Author)

A78-24000 Controller design for a manipulator using theory of variable structure systems. K.-K. D. Young (Drexel University, Philadelphia, Pa.). *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SMC-8, Feb. 1978, p. 101-109. 15 refs. Research supported by the Ford Motor Co.; Grants No. DAAB07-72-C-2059; No. AF-AFOSR-73-2570.

A new control algorithm is developed for manipulators using the theory of variable structure systems. The control is designed so that a new type of state space trajectories called sliding mode exists. Due to delays, neglected small time constants, and other idealizations, ideal

sliding modes as predicted by the theory do not exist. We have verified through hybrid simulation that trajectories which are close to ideal sliding modes exist when the controller is designed according to theory. To illustrate the design procedures, a two-joint manipulator is considered. (Author)

A78-24019 * # New dimensions for man. A. J. Louviere (NASA, Johnson Space Center, Spacecraft Design Div., Houston, Tex.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 14th, Washington, D.C., Feb. 7-9, 1978, Paper 78-325*. 7 p.

The functions of man in space have been in a state of constant change since the first manned orbital flight. Initially, the onboard crewmen performed those tasks essential to piloting and navigating the spacecraft. The time devoted to these tasks has steadily decreased and the crewman's time is being allotted to functions other than orbital operations. The evolving functions include added orbital operational capabilities, experimentation, spacecraft maintenance, and fabrication of useful end items. The new functions will include routine utilization of the crewman to extend mission life, satellite retrieval and servicing, remote manipulator systems operations, and piloting of free-flying teleoperator systems. The most demanding tasks are anticipated to be associated with construction of large space structures. The projected changes will introduce innovative designs and revitalize the concepts for utilizing man in space. (Author)

A78-24021 * # Outfitting for space. A. O. Brouillet (United Technologies Corp., Hamilton Standard Div., Windsor Locks, Conn.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 14th, Washington, D.C., Feb. 7-9, 1978, Paper 78-327*. 5 p. Contract No. NAS9-15290.

EVA missions, beginning with the Space Shuttle and continuing through the 80's and 90's are evaluated in an evolutionary perspective. The projected large space structures, to be assembled in orbit, will require EVA for their construction. Various parameters of EVA are analyzed, including: EVA tasks and system requirements, system pressurization level, and radiation protection. Existing technology and already proven EVA techniques are considered adequate for future EVA missions, with some modifications. Space suit pressure, for example, can be increased from 4 to 8 psi, depending on ambient pressure in the spacecraft. Radiation shielding might have to be improved for higher altitude LEO's. Also, new restraint systems will probably be required for the more complicated EVA tasks.

D.M.W.

A78-24100 * Until the sun dies. R. Jastrow (NASA, Goddard Institute for Space Studies; Columbia University, New York, N.Y.). New York, W. W. Norton and Co., Inc., 1977. 165 p. \$8.95.

This book gives a popular account of the forces that have shaped human beings into their present form and created the power of human intelligence, and considers the prospects for intelligent life on other planets in the solar system and elsewhere in the universe. The chain of events leading from the big bang to the origin of life on earth is reviewed together with the observations that established the expansion of the universe. Philosophical difficulties with the concept of a universe that has both a beginning and an end are pondered, steady-state cosmology is briefly explained, and the discovery of the relic microwave background is discussed. The formation of the solar system is recounted along with the scientific view of the origin of terrestrial life. Attention is given to the origin of cells and the evolution of oxygen-breathing life, multicelled creatures, armored animals, fishes, amphibians, early reptiles, dinosaurs, and mammals. The development of mammalian intelligence is traced from the early tree dwellers through monkeys, apes, ape men, humanoid tool makers, and primitive members of the genus Homo, to Homo sapiens. Possible evidence for the existence of life on Mars is evaluated together with prospects for communication or other contact with extraterrestrial intelligence. F.G.M.

A78-24249 # Modelling heart structure changes during adaptation to large loads (Modelirovanie izmenenii struktury serdtsa

pri adaptatsii k bol'shoi nagruzke). A. M. Berger. *Avtomatika i Telemekhanika*, Nov. 1977, p. 158-167. 14 refs. In Russian.

The analysis of the transient process of long-term heart adaptation to large loads is based on a mathematical model of an organism continuously synthesizing as many structures as are necessary to implement the function. The mechanism of initial increase and further decrease of the ratio of short-term to long-term structures in the heart muscle cells following load rise is explained; this mechanism may result in structure-dependent heart power alterations in the transient process of long-term adaptation. The simulation results are in qualitative agreement with available experimental data and reproduce certain poorly studied features of the modeled process. (Author)

A78-24366 # KC-135 boom operator's head-up display. R. L. Newman (Crew Systems Consultants, Yellow Springs, Ohio). *Journal of Aircraft*, vol. 15, Feb. 1978, p. 124-126.

A review of accidents during air-to-air refueling by a boom operator (BO), when the receiver aircraft flies in a close trail formation slightly below the tanker, reveals that refueling accidents could have been prevented by using a BO head-up display (HUD). The two criteria of refueling accidents were failure or inability of the BO to determine proximity to the refueling envelope limits, or accident caused by the BO going head-down to consult his instruments. Interviews with BOs suggest that a BO HUD would improve mission effectiveness and flight safety. A HUD would minimize the need to look at the instruments, with the result that hook-ups would be faster with fewer disconnects and flight safety would improve. Desirable minimum data needed by a BO in his field of view during HUD are mentioned. S.D.

A78-24574 # Oscillatory phenomena in the simulation of the long-term adaptation of the heart (Pro kolival'ni yavishcha pri modeliuванні trivaloi adaptatsii sertsia). A. M. Breger (Vsesoiuznii Naukovo-Doslidnii Institut Sistemnikh Doslidzhen', Ukrainian SSR). *Akademiia Nauk Ukrain'skoi RSR, Dopovidi, Seriya A - Fiziko-Matematichni ta Tekhnichni Nauki*, Nov. 1977, p. 1041-1045. 8 refs. In Ukrainian.

The paper studies the periodic variability of mass and ratio of structures in heart myoblasts, observed during the mathematical modeling of the long-term adaptation of the heart. It is suggested that a similar mechanism of periodic structural changes underlies a number of oscillatory physiological processes in different biological objects. B.J.

A78-24595 # Functioning of intramuscular peripheral hearts in the dog under conditions of general hypothermia (O funktsionirovanii vnutrimyshechnykh perifericheskikh serdets u sobak v usloviakh obshchei gipotermii). N. I. Arinchin, G. D. Nedvetskaia, and G. F. Borisevich (Akademiia Nauk Belorusskoi SSR, Institut Fiziologii, Minsk, Belorussian SSR). *Akademiia Nauk BSSR, Doklady*, vol. 21, Oct. 1977, p. 952-954. 17 refs. In Russian.

A78-24818 * Thermoregulation is impaired in an environment without circadian time cues. C. A. Fuller, F. M. Sulzman, and M. C. Moore-Ede (Harvard University, Harvard Medical School, Boston, Mass.). *Science*, vol. 199, Feb. 17, 1978, p. 794-796. 21 refs. NSF Grant No. PCM-76-19943; Grants No. NSG-9045; No. NIH-GN-22085.

Thirteen adult male squirrel monkeys were restrained to a metabolism chair for periods of two or more weeks within an isolation chamber having controlled environmental lighting and ambient temperature. The monkeys were subjected to mild 6-hour cold exposures at all circadian phases of the day. It was found that a prominent circadian rhythm in body temperature, regulated against mild cold exposure, was present in those monkeys synchronized in a 24-hour light-dark cycle. Cold exposures were found to produce decreased core body temperatures when the circadian rhythms were free running or when environmental time indicators were not present. It is concluded that the thermoregulating system depends on the internal synchronization of the circadian time-keeping system. S.C.S.

STAR ENTRIES

N78-16584 Colorado State Univ., Fort Collins.
EFFECTS OF MATURATION AND HYPOXIA ON SKELETAL MUSCLE Ph.D. Thesis

Alberto Hugo Sillau-Gilone 1977 110 p
 Avail: Univ. Microfilms Order No. 77-28328

Skeletal muscle capillarity, fiber composition and fiber geometry were studied using histochemical techniques, in normoxic and hypoxic rats and guinea pigs of different body weights. It was demonstrated that capillary density in the muscles of rats and guinea pigs is not affected by moderately severe hypoxia and that the number of capillaries around muscle fibers depends on their cross sectional area and on their oxidative activity. Dissert. Abstr.

N78-16585* National Aeronautics and Space Administration, Washington, D. C.

STUDY OF THE BIOLOGICAL EFFECTS OF LONG-TERM WEIGHTLESSNESS IN LABORATORY MODEL EXPERIMENTS ON MAMMALS

Dec. 1977 35 p refs Transl. into ENGLISH from 'Izucheniye Biologicheskikh Effektiv Dlitel'noy Nevesomosti v Laboratornykh Model'nykh Eksperimentakh na Mlekopitayushchikh Zhivotnykh', Rept. 10/77-1 Interkosmos Council, Moscow, 1977 p 1-40 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original Doc. Prep. by Interkosmos Council, Acad. of Sciences USSR and Directorate of Space Biol. and Med., Min. of Health USSR (Contract NASw-2790)

(NASA-TM-75076) HC A03/MF A01 CSCL 06S

Experimental ground and space flight hypokinesia and hypodynamia of monkeys, dogs and rats, as models for the effects of weightlessness in manned space flight were studied. Effects on nonspecific adaptation, the cardiovascular system, water and electrolyte metabolism and on skeletal muscles and bones of the limbs were of major interest. It is concluded that rodents are not suitable models for cardiovascular activity while dogs and monkeys are, and that all are suitable for the remaining types of studies. Hypodynamia is preferred over hypokinesia. Experiments with rats and dogs, for all functions studied, should provide body inclination to increase the central volume of blood. Author

N78-16586* National Aeronautics and Space Administration, Washington, D. C.

FORMATION OF ECTOPIC OSTEOGENESIS IN WEIGHTLESSNESS

Dec. 1977 8 p Transl. into ENGLISH from "Formirovaniye Ektopicheskogo Osteogeneza v Nevesomosti", Rept. (Moscow), 1977 p 1-6 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original Doc. Prep. by Acad. of Sciences USSR (Contract NASw-2790)

(NASA-TM-75079) Avail: NTIS HC A02/MF A01 CSCL 06S

An ectopic osteogenesis experiment aboard the Cosmos-936 biosatellite is described. Decalcified, lyophilized femur and tibia were implanted under the fascia or in the anterior wall of the abdomen in rats. Bone formation before and after the tests is described and illustrated. The extent of formation of ectopic bone in weightlessness did not differ significantly from that in the ground controls, but the bone marrow of the ectopic bone of the flight rats consisted exclusively of fat cells. The deficit of support-muscle loading was considered to cause the disturbance in skeletal bone tissue development. Author

N78-16587* National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va. Technology Utilization.

ADVANCES IN STERILIZATION AND DECONTAMINATION: A SURVEY

1978 190 p refs Prepared in cooperation with Bionetics Corp., Hampton, Va.
 (Contract NAS1-14209)

(NASA-SP-5105) Avail: NTIS HC A09/MF A01 CSCL 06M

Recent technical advances made in the field of sterilization and decontamination and their applicability to private and commercial interests are discussed. Government-sponsored programs by NASA produced the bulk of material presented in this survey. The summary of past and current research discussed is detailed to enhance an effective transfer of technology from NASA to potential users. Author

N78-16588* Los Alamos Scientific Lab., N. Mex.

LASER BACKSCATTERING MEASUREMENTS ON BIOLOGICAL CELLS: PRELIMINARY RESULTS

G. C. Salzman, B. J. Price, R. D. Hiebert, P. F. Mullaney, and J. W. M. Visser 1976 26 p refs Repr. from Proc. of the Workshop on separation of normal and Neoplastic Cells (Amsterdam), 1976 26 p Presented at the Workshop on Separation of Normal and Neoplastic Cells, Amsterdam, 9-11 Nov. 1976; sponsored by The Netherlands Soc. Against Cancer (Contract W-7405-eng-36)

(LA-UR-76-2462; Conf-761132-1) Avail: NTIS HC A03/MF A01

A cell flow-system instrument is described in which the light scattered by a cell as it passes through a focused helium-neon laser beam is detected simultaneously at 26 angles between 0 deg and 4.4 deg and at 176 deg with respect to the laser beam axis. The usefulness of backscatter in distinguishing among variously sized plastic microspheres is demonstrated. Preliminary results with mouse bone marrow cells are also discussed. ERA

N78-16589 Rutgers - The State Univ., New Brunswick, N. J.
THE EFFECT OF ACUTE ARTERIAL HYPOXIA ON THE PARAMETERS OF O₂ SUPPLY AND DEMAND IN THE RESTING GRACILIS MUSCLE OF THE ANESTHETIZED DOG Ph.D. Thesis

George Jeffrey Crystal 1977 177 p
 Avail: Univ. Microfilms Order No. 77-24965

Particular attention was given to the relative roles of local and remote vascular control mechanisms. Animals respired room air or various low O₂ gas mixtures. Steady state responses to hypoxia were obtained in intact (innervated) muscles and after (1) local denervation, (2) systemic alpha blockade with phenoxybenzamine, or (3) arterial baro- and chemoreceptor denervation. Results indicated that O₂ supply/demand balance in resting skeletal muscle during arterial hypoxia was not influenced by direct chemoreceptor-mediated vasoconstrictor nerve activity, reflex vasoconstrictor support, or the background level of sympathetic adrenergic vasoconstrictor nerve tone. Dissert. Abstr.

N78-16590 Bowling Green State Univ., Ohio.

THE RELATIONSHIP BETWEEN THE ACOUSTIC REFLEX AND LOUDNESS DISCOMFORT IN NORMAL AND SENSORINEURAL EARS Ph.D. Thesis

Harry Lee McLeod 1977 71 p
 Avail: Univ. Microfilms Order No. 77-23190

The relationship between loudness discomfort level (LDL) and the acoustic reflex threshold (ART) was investigated. Pre-recorded, randomly presented stimuli of 1000 Hz, 2000 Hz, and a multi-talker speech noise were presented to 15 normal and 15 sensorineural hearing-impaired listeners. The psychophysical method of constant stimuli was employed to determine the LDL. An analysis of variance was performed to determine if significant differences existed between LDL-ART measures for normal and hearing-impaired groups. A multiple regression analysis was used to determine the usefulness of ART measures in predicting LDL. Both LDL and ART were found to be significantly high for the hearing-impaired group. Ranges of prediction error were selected to investigate the ability of ART to predict LDL. Dissert. Abstr.

N78-16591 Texas Univ., Austin.
SLEEP STAGE CLASSIFICATION USING BEAT-BY-BEAT HEART RATE DATA Ph.D. Thesis
 Terry Paul Daubek 1977 108 p
 Avail: Univ. Microfilms Order No. 77-22936

Research to determine if computer analysis of heart rate data can be used to detect sleep stages in human beings is presented. Sleep staging has traditionally been detected and measured by examination of the electroencephalogram and the electro-oculogram. It is the goal of this research to develop a technique that will detect sleep stages using only measures extracted from heart rate data. The method used in this research involved the use of one night of data per subject which had been categorized using standard EEG examination. These data were used as training data for a cluster generation-template matching algorithm which in turn was used to categorize other nights of data from the same subject. The results of this research are based upon sixteen nights of data from three subjects. Each night of data was transformed using a Fourier analysis algorithm. Dissert. Abstr.

N78-16592 Syracuse Univ., N. Y.
PARTICLE DEPOSITION IN BENDS AND REPEATEDLY BIFURCATING TUBES Ph.D. Thesis
 Yung-Sung Cheng 1976 147 p
 Avail: Univ. Microfilms Order No. 77-24361

Two specific problems related to the local deposition of inhaled particles in the respiratory tract were studied: (1) inertial impaction in 90 deg bends, and (2) particle deposition in a tracheobronchial tree model. The equations of particle motion were solved analytically for an idealized airflow profile and numerically for a more realistic flow pattern in curved tubes. Deposition velocities were measured along both inner and outer edges of the daughter tubes of the second bifurcations in a tracheobronchial tree model consisting of four successive generations of bifurcations. Dissert. Abstr.

N78-16593 Michigan State Univ., East Lansing.
IMPLANTABLE ELECTROMAGNETIC FIELD PROBES IN FINITE BIOLOGICAL BODIES Ph.D. Thesis
 Seyed Hossein Mousavinezhad 1977 181 p
 Avail: Univ. Microfilms Order No. 77-25270

Theoretical and experimental results are presented on the study of a dielectrically coated, small spherical probe used to measure the induced EM fields in conducting biological bodies of finite extent. The receiving and radiating characteristics of the insulated probe were determined as functions of the electrical parameters and geometry of a spherical conducting body. A general theory for a wire probe in a volume conductor was presented and the relation between the output of the probe and the induced electric field in the body was derived. The expression for the input impedance was formulated based both on the matrix equation method and transmission line theory. Experimental results on the input impedance of insulated spherical probes and the measurements of the induced electric field inside conducting bodies are presented. Dissert. Abstr.

N78-16594 Notre Dame Univ., Ind.
THE ACTIVATION OF HUMAN PLASMINOGEN BY UROKINASE Ph.D. Thesis
 Bernard Norman Violand 1977 177 p
 Avail: Univ. Microfilms Order No. 77-27108

Plasminogen is the inactive plasma precursor of the proteolytic enzyme plasmin. The major physiological function of plasmin appears to be lysis of the fibrin clot. The molecular events which occur during the conversion of human plasminogen to plasmin by the human kidney activator, urokinase are discussed. The initial step in plasmin formation is the urokinase-catalyzed cleavage of an internal arginyl-valyl bond in native plasminogen (plasminogen a) to yield the two chain plasmin a molecule. This plasmin a contains a heavy chain (H a) derived intact from the original amino terminus of plasminogen a and a light chain derived intact from the carboxyl terminus of plasminogen a. However, the final stable plasmin, plasmin b, which is obtained, contains a heavy chain, H b, which arises by plasminolysis of a small peptide from the amino terminus of H a. Alternatively, plasmin b can

be formed in a separate series of reactions which initially involves plasminolysis of plasminogen a to yield plasminogen b. Dissert. Abstr.

N78-16595 Iowa State Univ. of Science and Technology, Ames.
COMPREHENSIVE STUDY INTERRELATING CARDIAC FUNCTION AND FUNDAMENTAL MUSCLE MECHANICS Ph.D. Thesis

John Richard Buysman 1977 145 p
 Avail: Univ. Microfilms Order No. 77-25973

Fundamental muscle mechanics and basic physical principles are described and combined into a comprehensive functional model of the left ventricle which describes the entire cardiac cycle. It demonstrates quantitatively how cardiac function results, from simple interactions between the fundamental muscle components functioning in one dimension within the three-dimensional framework of the ventricle. A small digital computer program calculates and graphically presents information such as force, element lengths, velocities of shortening, pressure, and flow. Simulation of the model demonstrates complex internal and external relationships which cannot be measured directly. The interactions can be quantified, timed, and placed into appropriated perspective within the limits of the model. The model is used to study cardiac performance indices and define their limitations, interferences, and exceptions. Dissert. Abstr.

N78-16596 Oklahoma Univ. Health Sciences Center, Norman.
AN ANALYSIS OF ELECTRODERMAL REFLEX ACTIVITY Ph.D. Thesis

Patricia Jean Bernthal 1977 117 p
 Avail: Univ. Microfilms Order No. 77-26466

Some physiologic aspects of the electrodermal reflex were studied in cats in a quantitative fashion. The amplitude of the reflex over time declined to 50% of control in approximately 160 minutes. The reflex amplitude in intact anesthetized cats was significantly reduced, although not abolished, by spinal transection or midcollicular decerebration. Intravenous administration of epinephrine resulted in a dose-dependent inhibition of both the reflexly and peripherally evoked electrodermal responses. This inhibitory effects on the peripheral response was antagonized by the alpha-adrenergic blocker phentolamine, but not by the beta-adrenergic blocker propranolol. A vascular mode of inhibition was eliminated by the lack of effect of angiotensin on the electrodermal responses. The presence of a peripheral inhibitory alpha-adrenergic receptor in the sudomotor system was postulated. Dissert. Abstr.

N78-16597 Rochester Univ., N. Y.
BONE CELL COLLAGENASE Ph.D. Thesis
 J. Edward Puzas 1977 87 p
 Avail: Univ. Microfilms Order No. 77-25581

The enzyme necessary to initiate degradation of the organic collagen phase of bone was found in the culture fluids of resorbing bone. It is a true collagenase which is substrate specific Ca^{+2} requiring, inhibited by serum factors and cleaves a tropocollagen molecule into characteristic macromolecular fragments. The enzyme was demonstrated in an extract of freshly isolated fetal bone cells. In addition the secretory mechanism that is present in vivo is also present in the isolated cell preparation. In order to demonstrate an effect of parathyroid hormone (PTH) and other bone metabolic modifiers on the synthesis and secretion of collagenase it was necessary to develop a culture-assay system. Dissert. Abstr.

N78-16598 Georgetown Univ., Washington, D.C.
THREE-DIMENSIONAL RECONSTRUCTION AND DISPLAY OF ANATOMICAL AND PATHOLOGICAL STRUCTURES FROM THEIR SERIAL SECTIONS Ph.D. Thesis
 John Charles Mazziotta 1977 157 p
 Avail: Univ. Microfilms Order No. 77-26394

A computer system known as THREAD has the capability of producing three-dimensional images of both microscopic and gross structures when the input to the system is in the form of

two-dimensional serial sections. The serial input images can be in the form of 35 mm film negatives, obtained from serial electron or light micrographs, or in the form of digital magnetic tape on which are stored serial sets of cross-sectional computerized tomograms of live patients. The qualitative three-dimensional images can be either in the form of line-drawing contour-grams or in the form of shaded half-tone images. The quantitative results include sectional perimeters and areas as well as the total object volume. Quantitative results are obtained automatically and qualitative results require only minimal manual supervision for their production. Dissert. Abstr.

N78-16599 Texas Technological Univ., Lubbock.

A MATHEMATICAL ANALYSIS OF THE MUSCULO-SKELETAL SYSTEM OF THE HUMAN SHOULDER JOINT Ph.D. Thesis

Young-Pil Park 1977 191 p

Avail: Univ. Microfilms Order No. 77-25513

A mathematical model capable of predicting muscular tension characteristics for skeletal muscles in the human shoulder joint was developed. This was done by using the data that were collected through dissection of a cadaver and through physiological information about human skeletal muscles and anatomical characteristics of the human shoulder joint. General equations that can be applied to various individual persons who have different anthropometric dimensions were developed by using scale factors. Computer programs were developed to determine the muscular tension in muscles in the shoulder joint of various persons and to predict the linear coefficients between electromyographic electrical signal intensities and the muscular tensions of the skeletal muscles. Dissert. Abstr.

N78-16600 Cincinnati Univ., Ohio.

SOME LATENCY AND RELAXATION MEASURES OF THE ACOUSTIC REFLEX IN RESPONSE TO WHITE NOISE AND PURE TONES, IN SUBJECTS WITH NORMAL HEARING AND SUBJECTS WITH SENSORINEURAL HEARING LOSS Ph.D. Thesis

Zenobia Ratanshaw Bagli 1977 176 p

Avail: Univ. Microfilms Order No. 77-29702

Ten normal hearing subjects were matched in age and sex to ten subjects with mild to moderate sensorineural hearing loss. The reflex eliciting stimuli were comprised of pure tones (500 Hz, 1000 Hz, 2000 Hz) and white noise, with rise-decay times of 25 milliseconds and 50 milliseconds, signal duration of 500 milliseconds and an interstimulus interval of 3000 milliseconds. The results indicated that the time taken by the tympanic muscles in contracting and relaxing differs in normal ears and ears with sensorineural hearing impairment. Ears with sensorineural loss took longer to contract and relax than normal ears. These results were interpreted to be suggestive of some sort of neural delay either in encoding or in transmission, in the presence of sensorineural damage. Dissert. Abstr.

N78-16601 Virginia Univ., Charlottesville.

RETINAL ROD OUTER SEGMENT DISCS: A STUDY OF MEMBRANE STRUCTURE AND FUNCTION Ph.D. Thesis

Henry Gilbert Smith, Jr. 1977 138 p

Avail: Univ. Microfilms Order No. 77-28612

The photoactive discs of vertebrate photoreceptors, found within the retinal rod outer segments were studied. Osmotically intact discs were prepared from retinal rod outer segments by osmotic shock followed by flotation on 5% Ficoll. The lipid structure of discs was studied with the nonmembrane penetrating labeling reagent, trinitrobenzenesulfonate. It was concluded that the disc has a markedly asymmetric membrane with these lipids distributed preferentially in the outer surface. The possible function of the discs as light activated calcium stores was also studied and found to be important in visual excitation. Dissert. Abstr.

N78-16602 Oregon Univ., Eugene.

PHYSIOLOGICAL WORK CAPACITY AND EFFICIENCY OF ADULTS DURING SHORT DURATION HIGH INTENSITY WORK WHILE ENGAGED IN A SPECIFIC LOW CARBOHYDRATE, LOW CALORIE DIET Ph.D. Thesis

Peter Adrian Rich 1977 87 p

Avail: Univ. Microfilms Order No. 77-19353

The subjects, twenty-seven adult male ranging in age from 16 to 50 years, after random assignment to one of four experimental groups, underwent a testing period prior to embarking on the dietary regimen. The statistical analyses revealed no significant differences between any of the experimental groups on the variables that were studied. It was, therefore, concluded that the dietary regimen chosen for study did not place any limitation on the ability of the subjects engaged in this investigation, to perform short duration, high intensity work on the bicycle ergometer. These findings lead to the hypothesis that the experimental conditions had not sufficiently reduced body glycogen stores to a level that would have influenced work performance. It was further hypothesized that gluconeogenesis from proteins and fats in combination with the small amount of carbohydrate furnished by the diet was the mechanism by which the carbohydrate demands of the final work bout were met. Dissert. Abstr.

N78-16603 Pennsylvania Univ., Philadelphia.

PULMONARY ARTERIAL TREE: ARCHITECTURAL AND FUNCTIONAL DESIGN Ph.D. Thesis

Ramalingaier Gopalakrishnan 1977 209 p

Avail: Univ. Microfilms Order No. 77-19852

Histological studies were accomplished in the larger pulmonary arteries, fixed at different transmural loads, to examine their geometry, structure and their variation. Measurements of velocity profiles in the pulmonary trunk and main branches were also accomplished in anesthetized dogs. Model studies were designed to measure velocity profiles and dimensions in straight, elliptical vessels. To assess the importance of the observed geometric and structural features of the vessels in function, a nonlinear, distributed model was developed for a system incorporating the pulmonary trunk, main branches and lobar arteries. In conclusion, the observed geometry, structure and architecture appear essential for optimal function of the system. Thus alteration of any of these features may be expected to result in a deteriorated performance and pathological adaptation in the system. Dissert. Abstr.

N78-16604* National Aeronautics and Space Administration, Washington, D. C.

CERTAIN ASPECTS OF THE VESTIBULAR PROBLEM IN SPACE MEDICINE

Dec. 1977 29 p refs Transl. into ENGLISH from Nektoryye Aspekty Vestibulyarnoy Problemy v Kosmicheskoy Meditsine (Moscow), Report, 1977 p 1-34 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original Doc. Prep. by Interkosmos Council, Academy of Sciences, USSR, Moscow

(Contract NASw-2791)

(NASA-TM-75067) Avail: NTIS HC A03/MF A01 CSCL 06P

Vestibulovegetative disorders on manned space flights are discussed. A study relating to the vestibular stimuli in respiration, diaphoresis cardiac rhythm and a broad complex of hemodynamic indices was conducted. Certain tests for astronaut candidates are discussed. Author

N78-16605* National Aeronautics and Space Administration, Washington, D. C.

PROGNOSIS OF THE STATE OF HEALTH OF A PERSON UNDER SPACEFLIGHT CONDITIONS

Dec. 1977 27 p refs Transl. into ENGLISH from Prognozirovaniye Sostoyaniya Zdorov'ya Chelokova u v Usloviyakh Kosmicheskogo (Moscow), report, 1977 p 1-33 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Interkosmos Council, Academy of Sciences USSR, Moscow

(Contract NASw-2791)

(NASA-TM-75068) Avail: NTIS HC A03/MF A01 CSCL 06S

Methods of predicting the state of health and human efficiency during space flight are discussed. Diversity of reactions to the same conditions, development of extrapolation methods of prediction, and isolation of informative physiological indexes are among the factors considered. J.M.S.

N78-16606*# National Aeronautics and Space Administration, Washington, D. C.

MATHEMATICAL MODELLING OF A HUMAN EXTERNAL RESPIRATORY SYSTEM

Dec. 1977 21 p refs Transl. into ENGLISH from Matematicheskoye Modelirovaniye Sistemy Uneshnego Dykhaniya Cheloveka (Moscow), Report no. 10/77-1, 1977 p 1-15 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Interkosmos Council, Academy of Sciences USSR and Ministry of Health, Moscow

(Contract NASw-2790)

(NASA-TM-75069) Avail: NTIS HC A02/MF A01 CSCL 06P

A closed system of algebraic and common differential equations solved by computer is investigated. It includes equations which describe the activity pattern of the respiratory center, the phrenic nerve, the thrust produced by the diaphragm as a function of the lung volume and discharge frequency of the phrenic nerve, as well as certain relations of the lung stretch receptors and chemoreceptors on various lung and blood characteristics, equations for lung biomechanics, pulmonary blood flow, alveolar gas exchange and capillary blood composition equations to determine various air and blood flow and gas exchange parameters, and various gas mixing and arterial and venous blood composition equations, to determine other blood, air and gas mixing characteristics. Data are presented by means of graphs and tables, and some advantages of this model over others are demonstrated by test results.

Author

N78-16607*# National Aeronautics and Space Administration, Washington, D. C.

BASIC RESULTS OF THE MEDICAL RESEARCH CONDUCTED DURING THE FLIGHT OF TWO CREWS ON THE SALYUT-5 ORBITAL STATION

Dec. 1977 62 p Transl. into ENGLISH from "Osnovnyye Rezultaty Meditsinskikh Issledovaniy Provedennykh pri Polete Dvukh Ekipazhey na Orbital'noy Stantsii 'Salyut-5'". Rept. Interkosmos Council (Moscow), 1977 p 1-67 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Interkosmos Council, Acad. of Sci. USSR and the Directorate of Space Biol. and Med., Min. of Health USSR

(Contract NASw-2790)

(NASA-TM-75070) Avail: NTIS HC A04/MF A01 CSCL 06S

The study of the effect of space factors, especially weightlessness, on man, taking into account prophylactic measures and devices to counteract that effect was part of the program for two flights on the Salyut 5 orbital station. Information from the equipment on board was transmitted telemetrically including: an electrocardiogram; a sphygmogram of carotid and femoral arteries; a kinetocardiogram; a tacho-oscillogram of the humeral artery, perimetric oscillations of the femur, venous pulse and pressure in the jugular veins, vital capacity of the lungs, respiration rate and lung ventilation. Stress factors, metabolism, biological and bacteriological and other tests were included. A comparison was made between these data and pre- and postflight test results.

Author

N78-16608*# National Aeronautics and Space Administration, Washington, D. C.

DYNAMICS AND CERTAIN MECHANISMS IN THE CHANGES OF THE SKELETAL-MUSCULAR SYSTEM OF MAN UNDER BEDREST CONDITIONS

V. G. Oganov Dec. 1977 37 p refs Transl. into ENGLISH from "Dinamika i Nekotoryye Mekhanizmy Izmeneniy v Oponomyshcheynoy Sisteme Cheloveka v Usloviyakh Postelnogo Rezhima". Rept. Interkosmos Council (Moscow), 1977 p 1-40 Transl. by SCITRAN, Santa Barbara, Calif. Original doc. prep. by Interkosmos Council, Acad. of Sci. USSR and Directorate of Space Biol. and Med., Min. of Health, USSR

(Contract NASw-2791)

(NASA-TM-75073) Avail: NTIS HC A03/MF A01 CSCL 06S

Bed rest conditions evaluated varied in the longitudinal axis of the body, perpendicular to the vector gravitational forces, and the cranial portion of the body inclined from the horizontal. The duration of bed rest fluctuated in various experiments from 30 to 182 days. The state of muscle and neuromuscular system

was judged on the basis of the recording of various functional indices, as well as by certain results of morphological and biochemical studies and data from the study of motor functions.

Author

N78-16609*# National Aeronautics and Space Administration, Washington, D. C.

APPLICATION AND EFFECTIVENESS OF PROPHYLACTIC DEVICES IN MODEL EXPERIMENTS

L. I. Kakurin Dec. 1977 15 p refs Transl. into ENGLISH from "Primeneniye i Effektivnost' Profilakticheskikh Sredstv v Model'nykh Eksperimentakh". Rept. Interkosmos Council (Moscow), 1977 p 1-16 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Interkosmos Council, Acad. of Sci. USSR and Directorate of Space Biol. and Med., Min. of Health USSR

(Contract NASw-2790)

(NASA-TM-75074) Avail: NTIS HC A02/MF A01 CSCL 06D

Material is presented for evaluating the effectiveness of prophylactic devices intended for maintaining: a relatively high functional level of the cardiovascular system; the nerve and muscle apparatus; and the water and salt status. The effects of the following are analyzed: physical training, lower body negative pressure, regulation of water and salt consumption, pharmacological preparations, and a combination of these. The author points out the need for further research.

Author

N78-16610*# National Aeronautics and Space Administration, Washington, D. C.

MATTERS OF SIMULATION OF THE SEMICIRCULAR CANAL SYSTEM

V. S. Gurfinkel and S. V. Petukhov Dec. 1977 27 p refs Transl. into ENGLISH from "Voprosy Modelirovaniya Sistemy Polukruzhnykh Kanalov". Leningrad, 1977 p 148-160 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-2790)

(NASA-TM-75230) Avail: NTIS HC A03/MF A01 CSCL 06P

A scale model of the human semicircular canal system was developed based on the theory of dynamic similitude. This enlarged model makes it convenient to conduct tests on the vestibular processes and dynamics in the semicircular canals. Tests revealed hydromechanical interaction between canals, with asymmetry of the conditions of movement of the endolymph in the canals in opposite directions. A type of vestibular reactions, occurring with angular oscillations of the head, was predicted and demonstrated using this model and human test subjects.

Author

N78-16611* Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY MEDICAL AND BEHAVIORAL SCIENCES, NO. 19

12 Jan. 1978 108 p Transl. into ENGLISH from Selected Foreign Periodicals (USSR)

(JPRS-70469) Avail: NTIS HC A06/MF A01

The physiological effects of vibration were investigated and problems of protection from vibration were examined. Information concerning biochemistry, epidemiology, veterinary medicine, toxicology and other biomedical sciences is also presented.

B.L.P.

N78-16612* New York Univ., N. Y.

PHYSIOLOGICAL RESPONSES TO COLD Final Report, 1970 - 1976

Steven M. Horvath (Calif. Univ., Santa Barbara) Dec. 1976 27 p refs

(Grant PHS-1-R13-ES-01470-01)

(PB-273254/3; NIH/NIEHS-77/017) Avail: NTIS CSCL 06S

The successful response of man to a cold ambient environment, dependent upon behavioral and physiological mechanisms, was explored. It was found that behavioral factors involve a complex interplay utilizing other elements of the environment to protect against the impacting one. Physiological responses are also involved. The responses to cold environments are integrated within the thermoregulatory centers in the brain. Body size or obesity show no relation to shivering activity; relative humidity has no significant effect on heat loss. During conditions of exercise, however, total evaporative loss can be increased as a result of increased ventilation and the active secretion of sweat.

GRA

N78-16613# New York Univ., N. Y. Task Force for Research Planning in Environmental Health Sciences.

FEMALES AND HOT ENVIRONMENTS Final Report, 1970 - 1976

Steven M. Horvath (Calif. Univ., Santa Barbara) Oct. 1976 17 p refs

(Grant PHS-1-R13-ES-01470-01)

(PB-273257/6; NIH/NIEHS-77/017)

Avail: NTIS

HC A02/MF A01 CSCL 06S

Those responses of the female that are a result of cultural experience were separated from those that have a basis in physiological fact. Different investigators have reported levels of sweating in females to be similar, less than, or equivalent to those observed in male subjects. Since young women were the subjects of most studies, the influence of age and altered endocrine balance was not determined. Other areas needing clarification include the relation of menstruation and the ability to perspire; the relation of salt and water balance to the response of humans to hyperthermia; and details of the complex circulatory adjustments of women exposed to heat. GRA

N78-16614# Battelle Pacific Northwest Labs., Richland, Wash. **EVALUATING THE EFFECTS OF LOW-LEVEL CHRONIC EXPOSURES**

E. S. Gilbert Sep. 1976 18 p refs Presented at the 2nd ERDA Statist. Symp., Oak Ridge, Tenn., 25 Oct. 1976

(Contract E(45-1)-1830)

(BNWL-SA-5992; Conf-761023-4)

Avail: NTIS

HC A02/MF A01

Problems involved in assessing health effects of chronic low-level exposures to environmental contaminants are reviewed. This problem is illustrated by a study of health effects of occupational exposure to ionizing radiation at Hanford which was established in the 1940's as an installation for plutonium production. Over 33,000 workers have been employed there in jobs involving some exposure to radiation. Yearly records of this exposure were maintained for all such employees. The yearly exposures were measured in rems of ionizing radiation able to reach critical organs of the body. Even for those who routinely worked in radiation zones, yearly readings seldom exceeded one or two rems. Methods for assessing directly the health effects of continuing relatively small doses of radiation over a number of years are discussed that are applicable to evaluating exposures to other industrial and environmental contaminants. ERA

N78-16615# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: BIOMEDICAL AND BEHAVIORAL SCIENCES, NO. 18

29 Dec. 1977 64 p refs Transl. into ENGLISH from Russian articles

(JPRS-70395) Avail: NTIS HC A04/MF A01

An experienced pilot has developed his own image of flight, has worked out the skills to control the plane and read the instrument information only in the form inherent to him. He controls the plane with precise coordinated movements, spending a minimum of time in reading the information, and is thus less fatigued in flight. In order to keep the flight image vivid in his consciousness, the pilot must be trained constantly. If only one system of landing approach is used over a long duration, the special features of piloting according to a different system are erased from his memory. The flight image, the habits of working with cockpit equipment, and skill in determining the distance to the ground must be reestablished. A.R.H.

N78-16616# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: BIOMEDICAL AND BEHAVIORAL SCIENCES, NO. 20

17 Jan. 1978 56 p refs Transl. into ENGLISH from various Russian journal articles

(JPRS-70486) Avail: NTIS HC A04/MF A01

The history of environment protection in the U.S.S.R. is related with particular emphasis on the control of atmospheric air pollution. Test equipment is described for measuring the toxic hazards associated with polymerization and the effects of using polymers

in construction, and in every day life. Other topics addressed include: a comparison of the vitamin supplements used in hog feed in Bulgaria and the U.S.; food additives for livestock in the U.S.S.R.; water quality in reservoirs; and health education in the Soviet Union. A.R.H.

N78-16617 Arizona State Univ., Tempe.

SELF-REFERENT BEHAVIOR AS A FUNCTION OF LEADER-LED GROUPS Ph.D. Thesis

Roger Bownds Allen 1977 84 p

Avail: Univ. Microfilms Order No. 77-22440

Whether or not high levels of anxiety or the absence of a leader in a group affect the number of self-referent statements made in a discussion group were investigated. The population of the study consisted of 40 female undergraduate students. The high and low trait anxious groups were assigned to leadered and leaderless conditions. A videotaped model designed to increase self-referent statements was shown to all four experimental groups. Each group met for two 50 minute discussion sessions in which they talked about how they thought and felt about themselves as students. Audiotape recordings of the eight experimental sessions were made. The results indicate that neither high anxiety nor the absence of a leader had a significant effect on the number of verbalizations of self-referent statements. Dissert. Abstr.

N78-16618# Utah Univ., Salt Lake City. Dept. of Computer Science.

SENSORY INFORMATION PROCESSING Final Technical Report, 1 Jul. 1976 - 31 Mar. 1977

Thomas G. Stockham, Jr. Apr. 1977 117 p refs

(Contract DAHC15-73-C-0363)

(AD-A047200; UTEC-CSC-77-118)

Avail: NTIS

HC A06/MF A01 CSCL 09/4

Section I of this report discusses the theoretical underpinnings of a new mathematical model describing some of the perceptual characteristics of human sensory information processing. While much of the mathematics of the proposed model is explained here, experimental testing and verification has yet to take place. This work will continue to be pursued under alternate funding. Section II discusses in detail the background considerations necessary to understand the problems of removing atmospheric turbulence blur from images. This area of research is currently in transition from the stage of artificial computer models, to the stage of working with the simplest real data, i.e. case of a point light source, a star, viewed through the earth's atmosphere. Section III reports the background and progress to date on building the tools necessary for an image understanding system. These tools as described were incorporated into a manual image understanding system designed to do analysis by synthesis. The system handles two-dimensional single objects on non-textured backgrounds, but only at the level of a trial testbed. Necessary next steps in developing a working system are outlined. GRA

N78-16619# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.

KNOWLEDGE-BASED ADAPTIVE CURRICULUM SEQUENCING FOR CAI: APPLICATION OF A NETWORK REPRESENTATION

Keith T. Wescourt, Marian Beard, and Laura Gould 20 Sep. 1977 17 p refs

(Contracts N00014-76-C-0165; N00123-75-C-1528)

(AD-A047090; TR-288) Avail: NTIS MF A01 CSCL 05/9

One aspect of tutoring skills for technical subjects is individualized, adaptive sequencing of the problems given to students as learning exercises. A Curriculum Information Network (CIN) describes the relationships between the problems in a CAI curriculum and the concepts and skills that they are intended to teach. It is a basis for selecting problems for each student with respect to his evolving knowledge of those concepts and skills. This paper describes the application of a semantic network to represent the complex interrelationships among the skills in a CIN for the BASIC Instructional Program, a CAI problem-solving laboratory for introductory programming in the BASIC language. The semantic network is used in drawing complex inferences about the student's state of knowledge and the problems that

are appropriate to present to him. Such inferences enable more skillful problem sequencing by the CAI system. Author (GRA)

N78-16620* SRI International Corp., Menlo Park, Calif.
STUDY TO DESIGN AND DEVELOP REMOTE MANIPULATOR SYSTEMS Annual Report, 1 Aug. 1976 - 30 Nov. 1977

J. W. Hill and J. K. Salisbury, Jr. Nov. 1977 121 p refs
 (Contract NAS2-8652; SRI Proj. 4055)
 (NASA-CR-152092; AR-2) Avail: NTIS HC A06/MF A01 CSCL 05H

A description is given of part of a continuing effort both to develop models for and to augment the performance of humans controlling remote manipulators. The project plan calls for the performance of several standard tasks with a number of different manipulators, controls, and viewing conditions, using an automated performance measuring system; in addition, the project plan calls for the development of a force-reflecting joystick and supervisory display system. Author

N78-16621* Advisory Group for Aerospace Research and Development, Paris (France).

STUDIES ON PILOT WORKLOAD

Robert Auffret, ed. (Centre d'Essais en Vol, Bretigny-sur-Orge, France) Nov. 1977 125 p refs Partly in ENGLISH and FRENCH Presented at the Aerospace Med. Panel Specialists' Meeting, Cologne, 18-22 Apr. 1977
 (AGARD-CP-217; ISBN-92-835-0205-1) Avail: NTIS HC A06/MF A01

The different variables which can influence human performance during the operational use of helicopters or other aircraft having high acceleration loads are assessed to quantify the sum of work which can be provided at each moment during flight.

N78-16622* Italian Air Force Medical Service H. Q., Rome.
WORKLOAD AND OPERATIONAL FATIGUE IN HELICOPTER PILOTS

Gaetano Rotondo In AGARD Studies on Pilot Workload Nov. 1977 11 p refs
 Avail: NTIS HC A06/MF A01

The possible causes of the operational fatigue to which flight crews are subject during the performance of their duties are reviewed. The influence of the physical, psychic, and emotive components of the stress factor associated with the professional activities of helicopter pilots are analyzed and their effects in the genesis of flight fatigue is assessed. On the basis of this analytical survey, it is possible to conclude that the piloting of helicopters involves a psycho-physical workload that is not inferior to the one experienced by the pilots of faster and more powerful aircraft. Author

N78-16623* Army Aeromedical Research Lab., Fort Rucker, Ala. Aviation Psychology Div.

VISUAL WORKLOAD OF THE COPILOT/NAVIGATOR DURING TERRAIN FLIGHT

Michael G. Sanders, Mark A. Hofmann, Ronald R. Simmons, and J. Nicholas DeBonis In AGARD Studies on Pilot Workload Nov. 1977 9 p refs
 Avail: NTIS HC A06/MF A01

A high speed camera and a modified eye mark recorder were used to examine the oculomotor performance of the navigator/copilot during various tasks involved in nap-of-the-earth, contour, and low level flight of a UH-1H helicopter. The visual performance was examined during (1) visual time inside the cockpit on flight and engine instruments; (2) time inside the cockpit on the map and other navigational aids; and (3) time outside the cockpit in various windscreens sectors. A visual free time task was utilized to determine the amount of visual time the navigator had available, during flight over the prescribed course, for a nonflight related task. The data indicate that the navigator's normal workload was demanding: the visual free time task was utilized only 3% of the total time. The data also indicate that the duty of navigating required 92.2% of the copilots total visual time while the engine and flight instruments were utilized only 4% of the time. These data are discussed in relation to the copilot's specified duties. Author

N78-16624* Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.

IN-FLIGHT RECORDING OF HELICOPTER PILOT ACTIVITY

E. J. Lovesey In AGARD Studies on Pilot Workload Nov. 1977 11 p refs
 Avail: NTIS HC A06/MF A01

A fully portable cine camera fitted with a wide angle lens was used to record pilots' head and hand movements in 6 different helicopters and 2 fixed wing aircraft types during nap-of-the-earth, low level and other flight phases. Apart from highlighting problem areas in the cockpit, the film records show that activity patterns depend more upon the flight profile than upon the helicopter type or the individual pilot. Subsequent film analysis has shown that the pilot time tends to increase with decreasing height above the ground. During nap-of-the-earth tactical flying, a pilot may spend over a third of the time looking inside the cockpit at maps, instruments and radios. This is precisely the time when he needs to spend the maximum time looking outside to detect and evade potential hazards such as wires, trees, enemy positions etc. Reasons for the apparently paradoxical behaviour and the effect upon pilot work-load are discussed. Typical pilot activity patterns are presented, together with an example of how poor cockpit design can obviously increase work-load and reduce efficiency. Author

N78-16625* Army Aeromedical Research Lab., Fort Rucker, Ala. Aviation Psychology Div.

THE ASSESSMENT OF ROTARY WING AVIATOR PRECISION PERFORMANCE DURING EXTENDED HELICOPTER FLIGHTS

Michael A. Lees, Kent A. Kimball, and Lewis W. Stone In AGARD Studies on Pilot Workload Nov. 1977 13 p refs

Avail: NTIS HC A06/MF A01

Man machine system performance during a five day extended flight was evaluated with emphasis on the changes in pilot performance and aircraft stability during the stabilized 3-ft precision hover maneuver. Changes in subjective ratings of fatigue and flight performance and in the measurement of auditory reaction time are also discussed. Data obtained suggest the occurrence of a learning effect across the first day of extended flight. The most stable hover performance was observed during the second flight day. By the third flight day, pilots attempted to maintain high quality precision hovers through an increase in the number of control inputs. On the fourth day of flight the pilots have shifted their control technique from active control of the helicopter to a more passive strategy of responding to observed error. The subjective rating scales demonstrate a progressive increase in the rated levels of fatigue between and within flight days. This increase in the level of fatigue corresponds to a general decrease in the ratings of flight performance. Author

N78-16626* Centre d'Essais en Vol, Bretigny-sur-Orge (France).
EVALUATING THE WORK LOAD OF HELICOPTER PILOTS. IN-FLIGHT RECORDINGS OF HEART RATE AND CARDIAC ARRHYTHMIA [EVALUATION DE LA CHARGE DE TRAVAIL DES PILOTES D'HELICOPTERES: ENREGISTREMENTS EN VOL DE LA FREQUENCE ET DE LA VARIABILITE DUE RYTHME CARDIAQUE]

Bernard Vettes In AGARD Studies on Pilot Workload Nov. 1977 13 p refs Partly in FRENCH and ENGLISH

Avail: NTIS HC A06/MF A01

In-flight recordings were made of the heart rate and cardiac arrhythmia in four helicopter test pilots during increasingly difficult ILS approaches. Five types of tasks were identified, each task being repeated five times during the same flight. An analyses of the data obtained indicates an increase of heart rate with low concomitant rhythm variations, especially if the subject had a greater number of variations when at rest. This increase of cardiac rhythm is exacerbated by the addition of external function factors (turbulence). The influence of apprehension is evidenced by a sensible decrease in heart rate during successive repetitions of the same task. The inclusion of subjective criteria can provide some useful information. A study of arrhythmia appears to be a

better measure than the instantaneous heart rate; however, an exact relationship between these parameters and the aviator's workload can not yet be affirmed. Transl. by A.R.H.

N78-16627# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehring.

A STUDY ON PILOT'S WORKLOAD IN HELICOPTER OPERATION UNDER SIMULATED IMC EMPLOYING A FORWARD LOOKING SENSOR

R. Beyer *In* AGARD Studies on Pilot Workload Nov. 1977 11 p refs

Avail: NTIS HC A06/MF A01

Various measures of pilot workload are known which are presently applied to human engineering investigations. It is difficult, however, to find a measure which has proved to be universally applicable and adequately validated. Measures tailored to a specific application may be less flexible but can provide relevant and sufficient information on pilot workload. Some aspects of workload measurement are discussed, and some workload measurements and the results are presented by referring to flight tests with advanced displays for the helicopter. Author

N78-16628# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.

AIRCREW FATIGUE IN NONSTOP, TRANSOCEANIC TACTICAL DEPLOYMENTS

William F. Storm, Bryce O. Hartman, and Donald L. Makalous *In* AGARD Studies on Pilot Workload Nov. 1977 7 p refs

Avail: NTIS HC A06/MF A01

Stress and fatigue were evaluated in F-4D crews before and after flying nonstop, transoceanic deployments from New Mexico to Germany and return. The measurement battery consisted of subjective fatigue ratings, self ratings of fitness to fly, sleep logs, and biochemical analyses of urine samples for norepinephrine, epinephrine, 17-hydroxycorticosteroids, urea, sodium, and potassium. The magnitude and the consistency of behavioral and physiological changes indicated the occurrence of mild fatigue immediately after both flights. The fatigue was acute and was ameliorated by one uninterrupted sleep period. Author

N78-16629# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

ENDOCRINE-METABOLIC COST OF PILOTING F-104 G AIRCRAFT

Hans M. Wegmann, Reinhold Hermann, and Paul Kuklinski *In* AGARD Studies on Pilot Workload Nov. 1977 4 p refs

Avail: NTIS HC A06/MF A01

Metabolic endocrinological aspects of flight stress were studied in student pilots during a training course for the F-104 G. All of these were already experienced jet pilots. Responses to flying were evaluated by comparing pre- and postflight levels of blood constituents, including 11-hydroxycorticosteroids, glucose, adenosinetriphosphate, cholesterol, and the activity of three cell enzymes (MDH, GOT, GPT). From the results the following conclusions were obtained: 1. Flying the F-104 G caused significant changes of most parameters. 2. The blood constituents differed in their work-load sensitivity: 11-OHCS, GPT, and MDH proved to be the most sensitive, GOT, cholesterol, and ATP the most insensitive parameters for the load. Blood glucose does not seem to be an unequivocal variable to measure workload. Reviewing the pertinent literature and comparing the figures with those obtained from studies with standardized stressors, the operational significance of the results are discussed. Author

N78-16630# Dunlap and Associates, Inc., La Jolla, Calif. **METHODS TO ASSESS PILOT WORKLOAD AND OTHER TEMPORAL INDICATORS OF PILOT PERFORMANCE EFFECTIVENESS**

Clyde A. Britton *In* AGARD Studies on Pilot Workload Nov. 1977 7 p refs

Avail: NTIS HC A06/MF A01

A systematic approach to define, measure and describe how certain pilot-related variables influence carrier landing performance during sustained operations is outlined. Previous exploratory research on the interrelations between psychophysiological variables, pilot experience and performance is described. Pilot work activity, mood and sleep are identified as indicators of a pilot's temporal state of readiness. A field study design and techniques to measure and describe temporal readiness during prolonged flight operations are provided to demonstrate the methodology in an operational environment. Potential applications of the research are discussed along with the future role of temporal, psychological and other moderator variables in estimating pilot flight status. Author

N78-16631# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Inst. fuer Flugmedizin.

SUBJECTIVE RATINGS OF FLYING QUALITIES AND PILOT WORKLOAD IN THE OPERATION OF A SHORT HAUL JET TRANSPORT AIRCRAFT

K. Steininger *In* AGARD Studies on Pilot Workload Nov. 1977 12 p refs

Avail: NTIS HC A06/MF A01

A representative sample of pilots employed by an airline operating a short haul jet transport aircraft assessed the acceptability of the cockpit layout and instrumentation, the handling quality, and the feasibility of the system operation in regard to the pilots workload. The assessment consisted of two parts: (1) a questionnaire of 82 fixed items being answered on a 7 step rating scale, (2) a semi-structured interview concerning 19 items, being answered on tape recorder. The justification to apply subjective ratings as a scientific method, instead of measuring objectively the physiological, and psychological reactions of the pilot is to be seen in the output: Critical points and favourable capabilities of the man machine system can be evaluated economically and objectively, provided there is a carefully chosen questionnaire and interview strategy, a well established rating scale, and a sufficient sample of persons for statistical evidence of the data. Author

N78-16632# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

SUBJECTIVE STRESS ASSESSMENT AS A CRITERION FOR MEASURING THE PSYCHOPHYSICAL WORKLOAD ON PILOTS

Hans-Peter Goerres *In* AGARD Studies on Pilot Workload Nov. 1977 8 p refs

Avail: NTIS HC A06/MF A01

The psychophysiological workload induced by an activity depends not only on the duration and intensity of stressing stimuli, but also upon intra-individual factors in the stressed subject itself (physical features, functioning of sensory organs, vegetative status, and present state of health as a prerequisite to physical performance; job-related knowledge, abilities, skills, need for achievement, experience, emotional stress resistance as psychic and mental determinants of strain). The results obtained by using standardized interviews and questionnaires to assess these psychophysiological strain parameters in 217 pilots of various type aircraft used by the German Federal armed forces are presented. Author

N78-17100*# California Univ., Berkeley. Lawrence Radiation Lab.

LIGHT FLASH OBSERVATIONS: EXPERIMENT MA-106

T. F. Budinger, C. A. Tobias, R. H. Huesman, F. T. Upham, T. F. Wieskamp (Calif. Univ., Livermore Lawrence Livermore Lab.), J. U. Schott (Frankfurt Univ.), and E. Schopper (Frankfurt Univ.) *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 193-209 refs

Avail: NTIS HC A24/MF A01 CSCL 06P

The frequency, character, latitudinal dependence, and identity of cosmic particles that cause the light flash phenomenon were investigated with emphasis on radiation hazards of long term earth orbiting and interplanetary missions. Measurement of the

characteristics of the cosmic particle environment in the vicinity of the eye, measurement of dark adaptation, and continuous onboard accumulation of the light flash observations from astronauts and particle detectors throughout one complete orbit were accomplished. Results are presented and discussed. J.M.S.

N78-17102*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ZONE-FORMING FUNGI: EXPERIMENT MA-147

T. D. Rogers (Northrop Services, Inc., Houston, Tex.), M. E. Brower (Northrop Services, Inc., Houston, Tex.), and G. R. Taylor *In its* Apollo-Soyuz Test Proj., Vol. 1 1977 p 227-236 refs

Avail: NTIS HC A24/MF A01 CSCL 06C

Streptomyces levis was used as an experimental test microorganism to study alternating vegetative mycelial and spore ring periodicity during space flight. Culture methods and materials and in-flight operations for the experiment are described. A decreased growth rate periodicity and development of double spore rings immediately after flight were observed and are attributed to such variables as temperature, nutritional medium, and the physical force factors associated with the launch and recovery process. J.M.S.

N78-17103*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

MICROBIAL EXCHANGE: EXPERIMENT AR-002

G. R. Taylor, K. D. Kropp (Northrop Services, Inc., Houston, Tex.), M. R. Henney (Northrop Services, Inc., Houston, Tex.), S. S. Ekblad (Northrop Services, Inc., Houston, Tex.), A. A. Baky (Northrop Services, Inc., Houston, Tex.), T. O. Groves (Northrop Services, Inc., Houston, Tex.), T. C. Molina (Northrop Services, Inc., Houston, Tex.), J. G. Decelle (Northrop Services, Inc., Houston, Tex.), C. F. Carmichael (Northrop Services, Inc., Houston, Tex.), N. J. Gehring (Northrop Services, Inc., Houston, Tex.) et al *In its* Apollo-Soyuz Test Proj., Vol. 1 1977 p 237-255 refs

Avail: NTIS HC A24/MF A01 CSCL 06C

Components of the infectious disease process in space flight were evaluated by measuring alterations in three factors: (1) the composition of the microbial populations inhabiting the crewmembers and the spacecraft; (2) the ability of each crewmember's defense mechanism to resist infection; and (3) the ability of certain microorganisms to originate infections. The operational aspects associated with the experiment, the activities of medically important microorganisms recovered from the Apollo and Soyuz crewmembers, and the activities of the major groups of microorganisms recovered from the 10 sample sites of each crewmember are described. Results indicate that: (1) a variety of potential pathogens were recovered from each of the prime and backup crewmembers before and after flight; (2) no disease events were reported; and (3) *Candida albicans* and *Staphylococcus aureus* were transferred from one crewmember to another during the flight. Author

N78-17104*# Baylor Univ., Waco, Tex. College of Medicine. **CELLULAR IMMUNE RESPONSE: EXPERIMENT MA-031**

B. Sue Criswell and Kathy Cobb *In NASA*. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 257-262 refs

Avail: NTIS HC A24/MF A01 CSCL 06P

The cellular immune response of ASTP crewmembers was studied before and after the flight. Parameters studied were white blood cell concentrations, lymphocyte numbers, B- and T-lymphocyte responsiveness to PHA, pokeweed mitogen, Concanavalin A, and influenza virus antigen. Changes in the responsiveness of peripheral blood lymphocytes to phytohemagglutinin (PHA) occurred in the cellular immune response but no quantitative changes in lymphocytes were noted. Results are compared with lymphocytic changes that were noted during the Skylab mission. Author

N78-17105*# Baylor Univ., Waco, Tex. College of Medicine. **POLYMORPHONUCLEAR LEUKOCYTE RESPONSE: EXPERIMENT MA-032**

R. Russell Martin, Glenn A. Warr, Margaret J. Putman, Diane H. Kentor, and Carolinda L. Holleman *In NASA*. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 263-279 refs

Avail: NTIS HC A24/MF A01 CSCL 06P

The possible effects of space flight and weightlessness on polymorphonuclear leukocyte (PMN) function, the body's defense against bacterial infection, were investigated in terms of space flight of long duration. Serial blood samples obtained from crewmembers of the ASTP and normal control subjects were tested for total leukocyte count, differential count, leukocyte migration and chemotaxis, phagocytic ability, and cytoplasmic granules stained for leukocyte acid and alkaline phosphatase. The effects of inhalation of propellant gases by the crewmembers and the inception of corticosteroid therapy were also studied. No abnormality in PMN function was noted. Results are discussed. J.M.S.

N78-17106*# Baylor Univ., Waco, Tex. College of Medicine. **KILLFISH HATCHING AND ORIENTATION: EXPERIMENT MA-161**

H. W. Scheld, A. A. Baky (Northrop Services, Inc., Houston, Tex.), J. F. Boyd (Northrop Services, Inc., Houston, Tex.), V. B. Eichler (Wichita State Univ., Kas.), P. M. Fuller (Louisville Univ., Ky.), R. B. Hoffman, J. R. Keefe (Louisville Univ., Ky.), K. P. Kuchnow (Texas A. and M. Univ., College Station), J. M. Oppenheimer (Bryn Mawr College, Pa.), G. A. Salinas (Northrop Services, Inc., Houston, Tex.) et al *In NASA*. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 281-305 refs

Avail: NTIS HC A24/MF A01 CSCL 06C

The embryonic development and vestibular adaptation in space flight of killfish *Fundulus heteroclitus* were studied. The experiment package consisted of a series of staged embryos and a series of juvenile fish. The experiment theory, data collection techniques, experiment execution procedures, and postflight analysis are discussed. Results of striped-drum tests, parabolic flight tests, light orientation tests, and otolith tests are presented along with results of microscopic examinations of the embryonic development of the central nervous system, the peripheral vestibular apparatus, the eye, and the cardiovascular system. Development rate under space flight conditions is described. No radical changes in vestibular function and in embryonic development were detected. J.M.S.

N78-17646 Temple Univ., Philadelphia, Pa.

EFFECTS OF ENDURANCE TRAINING ON LEFT VENTRICULAR FUNCTION IN THE DOG: A CINEANGIOGRAPHIC STUDY Ph.D. Thesis

Theodore Frank Ritzer 1977 303 p

Avail: Univ. Microfilms Order No. 77-21839

The effects of endurance training on in vivo function and dimensions of the left ventricle (LV) were investigated using biplane cineangiographic techniques. Group 1, consisting of seven dogs, underwent aseptic surgery during which a pressure transducer was placed in the LV via an apical puncture wound. Group 2, consisting of three dogs, were sham operated and served as controls. The heart rate response to exercise on a treadmill was evaluated in both groups after four weeks and the dogs were angiographically studied. Results indicated that while the LV surgery did not affect the physical work capacity in group 1, it did depress their LV performance. No significant differences in angiographically determined LV mass or midventricular end diastolic wall thickness were found between the groups. It was concluded that the LV adapts to the intermittent volume load of chronic endurance training as much it would adapt to other forms of compensated morphologically induced volume loads. Dissert. Abstr.

N78-17647*# National Aeronautics and Space Administration, Washington, D. C.

PUBLICATIONS OF THE SPACE BIOLOGY PROGRAM FOR 1975-1977: A SPECIAL BIBLIOGRAPHY.

J. C. Felt, comp. and T. W. Halstead, comp. Jan. 1978 26 p (NASA-TM-79324) Avail: NTIS HC A03/MF A01 CSCL 06C

Documents cited represent research encompassing several disciplines of space biology: botany and plant pathology, physiology and biophysics, agricultural and environmental sciences, anatomy and embryology, cellular and comparative biology, horticulture and aerospace biology. M.V.

N78-17648* McDonnell-Douglas Astronautics Co., St. Louis, Mo.

MICROBIAL LOAD MONITOR

R. S. Caplin and E. R. Royer 1 Feb. 1978 16 p refs

(Contract NAS9-11877)

(NASA-CR-151623; MDC-E1822)

Avail: NTIS

HC A02/MF A01 CSCL 06C

Attempts are made to provide a total design of a Microbial Load Monitor (MLM) system flight engineering model. Activities include assembly and testing of Sample Receiving and Card Loading Devices (SRCLDs), operator related software, and testing of biological samples in the MLM. Progress was made in assembling SRCLDs with minimal leaks and which operate reliably in the Sample Loading System. Seven operator commands are used to control various aspects of the MLM such as calibrating and reading the incubating reading head, setting the clock and reading time, and status of Card. Testing of the instrument, both in hardware and biologically, was performed. Hardware testing concentrated on SRCLDs. Biological testing covered 66 clinical and seeded samples. Tentative thresholds were set and media performance listed. Author

N78-17649 Iowa State Univ. of Science and Technology, Ames. **THE EFFECTS OF MALDISTRIBUTION ON THE UPTAKE AND DISTRIBUTION OF INERT GASES IN THE HUMAN LUNG** Ph.D. Thesis

Ferruh Erturk 1977 129 p

Avail: Univ. Microfilms Order No. 77-25981

Mathematical models to describe the effect of the maldistribution of ventilation perfusion ratios in the human lung were developed for two new noninvasive measuring techniques. The two techniques, which employed sinusoidal and stepwise inert gas concentration forcing functions were tested simultaneously on healthy human subjects. The results show a one-compartment homogeneous lung model describes the normal lung satisfactorily. In the frequency-response method, halothane was used as the inert gas agent. In the step method, five inert gases ranging from very low solubility (helium) to very high solubility (acetone) were used with halothane. V/Q ratios of approximately unity were obtained from both methods. Ether and acetone show abnormally high V/Q ratios due to absorption in higher airways. Presence of an equivalent dead-space can be depicted.

Dissert. Abstr.

N78-17650 Stanford Univ., Calif.

TOTALLY IMPLANTABLE BIDIRECTIONAL PULSED DOPPLER BLOOD FLOW TELEMETRY: INTEGRATED TIMER-EXCITER CIRCUITRY AND DOPPLER FREQUENCY ESTIMATION Ph.D. Thesis

Henry Vandegrift Allen 1977 180 p

Avail: Univ. Microfilms Order No. 77-25639

A totally implantable directional pulsed Doppler blood flowmeter is disclosed that resolves problems of baseline and scale factor drift. The device is based on two custom designed integrated circuits and measures .29 x 3.8 x 0.8 cm, the smallest implantable flowmeter realized to date. The design of portions of the system intended for long term implantation in chronic animal research is described. Dissert. Abstr.

N78-17651 Stanford Univ., Calif.

A NONLINEAR MODEL OF THE HUMAN EEG SIGNAL DURING PHOTIC STIMULATION Ph.D. Thesis

John Richard Nickolls 1977 223 p

Avail: Univ. Microfilms Order No. 77-25708

The human electroencephalogram (EEG) exhibited many complex and poorly understood responses to stroboscopic flashes and other uniform field photo stimulation. A class of phenomena involving photic stimulation and the EEG alpha rhythm was

characterized in terms of the simplest nonlinear input-output model exhibiting these phenomena. Quantitative testing and evaluation of the characterization were achieved with digital model simulations and experimental EEG data. The fit was particularly good for periodic stimuli and extended over a wide range of frequencies. The model was consistent with what is known about the physiology of alpha wave generation, and unified several apparently disparate phenomena with one nonlinear mechanism. It also suggested an unusual sampled-data structure for the relationships between saccadic eye movements, EEG alpha activity, cortical excitability, and visual perception. Dissert. Abstr.

N78-17652 Wisconsin Univ., Madison.

VENTILATION-PERFUSION RATIO DISTRIBUTIONS FROM MULTIPLE INERT-GAS ELIMINATION DATA: MASS-SPECTROMETER MEASUREMENT AND NONLINEAR PARAMETER ESTIMATION Ph.D. Thesis

Samuel Martin Mastenbrook, Jr. 1977 173 p

Avail: Univ. Microfilms Order No. 77-19721

A sensitive and versatile quadrupole mass spectrometer system was constructed as a alternative to the gas chromatography technique for measuring multiple inert gas elimination at trace concentrations. A number of gases were investigated for this application, and a set of six was selected that is compatible with both ventilation-perfusion distribution theory and quadrupole mass spectrometer characteristics. Dissert. Abstr.

N78-17653 Kansas Univ., Lawrence.

A COMPUTER BASED MEDICAL ULTRASOUND B-SCAN SYSTEM Ph.D. Thesis

Jonathan Ophir 1977 307 p

Avail: Univ. Microfilms Order No. 77-28900

A computer based medical ultrasound B-scan system was designed, constructed and made operational. The system accomplishes three objectives: (1) to acquire, process, and display wide amplitude dynamic range echo signals in real time; (2) to establish a flexible hardware-software research system to be used to learn how best to present ultrasonic data to a physician for improved medical diagnosis; and (3) to reduce the dependence of ultrasound images on scanning technique and on machine settings. Ultrasound echoes are acquired from a patient, digitized and transferred to a computer via a sampling interface. After appropriate software manipulation of the echo data to remove its dependence on machine settings, it is processed and displayed as a brightness modulated image with 128 x 128 resolution cells and up to 15 gray levels. Dissert. Abstr.

N78-17654 Texas Univ., Austin.

THE EFFECTS OF BURN INJURY AND POST BURN COOLING IN THE MICROCIRCULATION Ph.D. Thesis

Donald Charles Ross 1977 118 p

Avail: Univ. Microfilms Order No. 77-29085

Tests were performed on over 200 hamster cheek pouch preparations in which standard burns of various temperatures and durations were created to produce predictable impairment of blood flow in the localized microvasculature. Subsequently, after a delay period of 10 minutes, the temperature of the tissue at the burn site was reduced to a value between 3 C and 25 C for either 5, 30, or 60 minutes and the recovery of circulatory function measured. The level of activity in the blood vessel was assessed by visual monitoring for 2 hours subsequent to termination of cooling therapy. It was observed that, in general, flow returned first to capillaries followed by veins and arteries. For each duration of cooling an optimum temperature was identified which yielded a maximum recovery of flow to the occluded vessels. The most effective cooling therapy is with short initiation delays and long cooling intervals. Dissert. Abstr.

N78-17655 Civil Aeromedical Inst., Oklahoma City, Okla.

THE ROLE OF MONAMINE OXIDASE INHIBITION IN THE ACUTE TOXICITY OF CHLORDIMEFORM

Paul W. Smith (Oklahoma Univ., Oklahoma City), Casey P. Robinson, Jane D. Zelenski (Oklahoma Univ., Oklahoma City), and Boyd R. Endecott Aug. 1977 13 p refs

(AD-A045507; FAA-AM-77-19)

Avail: NTIS

HC A02/MF A01 CSCL 06/15

Data from experiments on male rats are presented to determine whether drugs which interfere with central amine mechanisms would decrease the lethality of the acaricide chlordimeform or increase chlordimeform lethality. Neither reducing serotonin synthesis with p-chlorophenylalanine, reducing norepinephrine synthesis with DL-alpha-methyl-p-tyrosine nor depleting both amines with reserpine affected the lethality of chlordimeform. Blocking alpha-adrenergic receptors with phentolamine or the serotonergic receptors with methysergide, or both, did not influence chlordimeform lethality. The adrenergic agonist drug phenylephrine also did not affect chlordimeform lethality. Thus, the results indicate that: (1) monamine oxidase inhibition does not play a major role in acute chlordimeform lethality, (2) none of the drugs tested shows promise in the treatment of chlordimeform poisoning, and (3) aerial applicators or others would appear to incur little or no extra risk should they be taking any of the above drugs during potential exposure to chlordimeform. Author

N78-17657# Civil Aeromedical Inst., Oklahoma City, Okla.
STRESS IN AIR TRAFFIC PERSONNEL: LOW-DENSITY TOWERS AND FLIGHT SERVICE STATIONS
 C. E. Melton, R. C. Smith, J. M. McKenzie, S. M. Wicks, and J. T. Saldívar Sep. 1977 19 p refs
 (AD-A046826; FAA-AM-77-23) Avail: NTIS
 HC A02/MF A01 CSDL 05/10

Stress and anxiety levels were measured in 10 air traffic control specialists (ATCS) at two low-traffic-density towers, Fayetteville, Arkansas, and Roswell, New Mexico, and in 24 flight service (FS) specialists at Oklahoma City, Oklahoma, Fayetteville, Arkansas, and Roswell, New Mexico. Physiological measurements consisted of heart rate and urine biochemical analysis for 17 ketogenic steroids, epinephrine, and norepinephrine. On-duty arousal in ATCS's and FS specialists was evident both physiologically and psychologically; such arousal was within psychologically normal limits and was generally low physiologically compared to other air traffic control (ATC) facilities that have been studied in the past. Physiological stress levels at these low-density towers and flight service stations were also low compared to other ATC facilities that were studied previously. It is concluded that it is inappropriate to describe all air traffic control work, as is commonly done in the popular press, as unusually stressful. Such accounts in the popular press tend to deal with the exceptional rather than with the typical controller or facility. Author

N78-17658# Advisory Group for Aerospace Research and Development, Paris (France).
THE USE AND ABUSE OF SOCIAL DRUGS
 Harry C. Holloway, ed. Jan. 1978 53 p refs Conf. held at Köln, West Germany, 18-22 Apr. 1977
 (AGARD-CP-218) Avail: NTIS HC A04/MF A01

The conference proceedings on the use and abuse of social drugs are reported. Topics discussed include: (1) the need for drugs and alcohol programs that are unique to military organizations; (2) the influence of tobacco from a medical standpoint on French pilots; (3) the United Kingdom approach to alcoholism in air crews; (4) diagnosis of alcoholism: The Munich alcoholism test; and (5) influence of socially used drugs on vision and vision performance.

N78-17659# Walter Reed Army Inst. of Research, Washington, D.C. Dept. of Military Psychiatry.
THE NEED FOR DRUG AND ALCOHOL PROGRAMS THAT ARE UNIQUE TO MILITARY ORGANIZATIONS
 Larry H. Ingraham /In AGARD The Use and Abuse of Social Drugs Jan. 1978 6 p refs

Avail: NTIS HC A04/MF A01

An epidemiological field study of illicit drug use is the basis for this study. The study used multidisciplinary methods including biochemical measures, mass questionnaire surveys, depth interviews, archival record searches, and participant observation. The details were reported elsewhere, but the themes and major findings are reviewed to understand succeeding arguments and propositions. Author

N78-17660# Ministère de l'Air, Paris (France).

THE INFLUENCE OF TOBACCO FROM A MEDICAL STANDPOINT ON FRENCH PILOTS [INFLUENCE DU TABAC DANS L'EXPERTISE MEDICALE DES FORCES AERIENNES FRANCAISES]

R. Carre, J. L. Charrieau, A. Thabaut, J. L. Durosoir, J. Hainaut, A. M. Clauzel, G. Trinquet, and A. Meyer /In AGARD The Use and Abuse of Social Drugs Jan. 1978 10 p refs In FRENCH

Avail: NTIS HC A04/MF A01

Some of the following items were discussed and analyzed in detail in reference to the influence of tobacco on the performance expertise of navigation personnel such as mechanics, pilots, and radio navigators: (1) the influence of tobacco on ventilation and pulmonary diffusion; (2) spirometric scanning; and (3) measurement of carbon monoxide transfer. Tobacco influence on the dosage of alpha 2 macroglobulin and a protamine test were examined. Results of these tests showed better evidence of vascular risks factors between smokers and nonsmokers. A statistical comparison of various protein series of pilots, smokers and nonsmokers showed significant decrease of immunoglobulin G and a significant rise in the rate of alpha 1 antitrypsine and haptoglobin with smokers in comparison to nonsmokers.

Transl. by B.B.

N78-17661# Royal Air Force, Wroughton (England).
THE UK APPROACH TO ALCOHOLISM IN AIR CREW
 D. N. Johnstone /In AGARD The Use and Abuse of Social Drugs Jan. 1978 3 p
 Avail: NTIS HC A04/MF A01

It was determined that it is appropriate to deal with an individual as an alcoholic by reference to the World Health Organization definition. It is argued that to return to moderate use of ethanol is a desirable, and even an attainable goal for an alcoholic, however, evidence is not convincing. The risk of returning to the former level of abuse cannot be tolerated in military aviation. It is therefore demanded that total and permanent abstinence be the goal of treatment. There appears to be two statistical peaks of alcoholic drinkers in UK service population; one composed of single airmen, of average age 21, and the second of married men, average 38 years. (The aircrew fall into the second group.) G.Y.

N78-17662# Deutsche Forschungsanstalt fuer Psychiatrie (Max-Planck-Institut), Munich (West Germany).
DIAGNOSIS OF ALCOHOLISM: THE MUNICH ALCOHOLISM TEST (MAT)
 C. Ringer, W. Feuerlein, H. Kufner, and K. Antons /In AGARD The Use and Abuse of Social Drugs Jan. 1978 8 p

Avail: NTIS HC A04/MF A01

A diagnostic instrument which would permit sufficiently reliable differentiation between alcoholics and healthy as well as sick persons was developed, and empirically tested. For this purpose roughly 250 diagnostically relevant items were selected from the extensive literature on alcoholism and in three separate phases with a total of 1335 patients evaluated for their ability to differentiate. The best items were selected on the basis of various statistical criteria and then cross validated. The result is the Munich Alcoholism Test, which consists of two complementary parts: a seven item physician's assessment part, and a 24 item self assessment part. Author

N78-17663# California Univ., Berkeley.
INFLUENCE OF SOCIALLY USED DRUGS ON VISION AND VISION PERFORMANCE

A. J. Adams, B. Brown, M. C. Flom, A. Jampolsky, and R. T. Jones /In AGARD The Use and Abuse of Social Drugs Jan. 1978 8 p refs

Avail: NTIS HC A04/MF A01

In a four-year study on vision and vision performance the drug and placebo treatments were administered double blind using replicated, balanced Latin Square design. The major oculomotor findings are (1) an increase in tonic convergence, (2) the maximum velocity of smooth eye tracking is decreased by alcohol and not by marijuana, (3) optokinetic nystagmus and

peripheral gaze nystagmus are affected by both drugs but more by alcohol, (4) pupil size is reduced by marijuana and unaffected by alcohol. The major visual sensory findings are (1) no change in visual acuity with either drug, (2) a marked reduction in the acuity of moving objects by alcohol and to a lesser extent by marijuana, (3) a prolonged glare recovery associated with either drug, (4) small reduction in color discrimination similar to those seen in mild protonomaly, and (5) a decrease in visual search time for alcohol but not for marijuana. In general combined doses of alcohol and marijuana failed to support a simple additive model for drug activity. All observed changes reached a maximum within 2 hours, and lasted for up to 6 hours after drug ingestion, and most of the changes are dose related. Author

N78-17664* # Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. Dept. of Physiology.
SPECIALIZED PHYSIOLOGICAL STUDIES IN SUPPORT OF MANNED SPACE FLIGHT Final Report, Dec. 1977
Dec. 1977 108 p refs
(Contract NAS9-14920)
(NASA-CR-151626) Avail: NTIS HC A06/MF A01 CSCL 06P

Breath-by-breath measurements of pulmonary capillary O₂ transfer and ventilation with a box-balloon spirometer and mass spectrometer were made on 3 subjects before, during and after 10 min of lower body negative pressure (LBNP) at -20, -40 and -60 Torr with arterial samples at -60 Torr. Deficits in blood O₂ stores (O₂B) were noted during LBNP with repayment of O₂B during recovery being related to the intensity of LBNP stress. Concurrent calf volume, measured with a Hg strain gauge, decreased towards baseline well before the peak rise in pulmonary capillary O₂ transfer after the release of LBNP which signified that O₂B changes were related to blood volume shifts. The return of O₂-depleted pooled blood to the central circulation during the first min. of recovery caused significant stress-related hyperpnea which peaked near 30 sec. and returned to near baseline after the first min. Three-compartment lung model analyses indicated an increase in the ventilated unperfused lung fraction from 0.09 to 0.17 with the effective compartment decreasing from 0.83 to 0.77. It appears that the 30% increase in ventilation equivalent was primarily the result of less effective lung perfusion during the LBNP. Author

N78-17665 # Naval Aerospace Medical Research Lab., Pensacola, Fla.
THE EFFECT OF CAFFEINE ON HUMAN DARK ADAPTATION Interim Report
Tommy R. Morrison and Gerald M. Long 6 Apr. 1977 34 p refs
(AD-A043298; NAMRL-1235) Avail: NTIS HC A03/MF A01 CSCL 06/15

The consumption of caffeine by naval personnel in the operational environment is extensive and frequent. In particular, pilots, aircrewmembers, watchstanders, and drivers often consume coffee prior to their performance of missions or tasks at night. The present two experiments were designed to investigate the effects of caffeine upon the absolute detection thresholds during dark adaptation. Within certain subjects caffeine consumption resulted in lower detection thresholds. The caffeine enhancement effect was significant only during the portion of dark adaptation following the rod-cone break. No evidence was found for a detrimental effect of caffeine on dark adaptation. Author (GRA)

N78-17666 # Human Engineering Labs., Aberdeen Proving Ground, Md.
PHYSIOLOGICAL CORRELATES OF PERFORMANCE IN A LONG DURATION REPETITIVE VISUAL TASK Final Report
Nicholas John Carriero Jun. 1977 28 p Repr. from the book "Vigilance: Theory, Operational performance and Physiological Correlates" New York, Plenum Press, 1977
(AD-A043047; HEL-TM-21-77) Avail: NTIS HC A03/MF A01 CSCL 01/10

This study examined the effectiveness of heart activity (HR), respiration (RESP), muscle activity (EMG), skin conductance (SCL),

and brain wave activity (EEG) as discriminators of correct vs. incorrect performance in a repetitive visual task of approximately 2 hours' duration. Separate analyses were made of the data to distinguish the operation of task difficulty from performance accuracy. In addition, both of the analyses were repeated using standard score transforms of the raw data to compensate for individual differences. An interactive statistical design was employed to assess the differential changes of the physiological variables with accuracy over time. This design proved to be of crucial importance in assessing this relationship since the accuracy main effect of RESP, EMG, and HR was insignificant in all four data treatments. The accuracy-by-time interactions were significant in a number of instances and established the efficacy of these parameters as discriminators of performance adequacy. Additionally, the standard score transforms proved essential to establishing these relationships when the variance in task difficulty was eliminated. The implication of these findings for the development of an alertness indicator is also discussed. Author (GRA)

N78-17667 # Dynatech R/D Co., Cambridge, Mass.
DEVELOPMENT OF A SYNTHETIC POLYMER BURN COVERING Progress Report, 1 Jan. - 30 Jun. 1977
J. B. Gregory, J. D. Gresser, and D. L. Wise 18 Jul. 1977 38 p ref
(Contract N00014-73-C-0201)
(AD-A042459; Dynatech-1631) Avail: NTIS HC A03/MF A01 CSCL 06/12

During the period January 1, 1977, to June 30, 1977, a new plasticized version of the poly-epsilon-caprolactone (PCL) wipe-on solution designed for use as an immediate post-burn treatment has been evaluated at NMRI on pigs under the supervision of Captain Burgoon D.V.M. Initial results show a significant improvement in the rate of burn healing and reduction of scar formation. The up-take of labelled proline has been demonstrated to correlate with formation of new collagen in burned areas using rats. Using C(14) labelled PCL, it has been demonstrated that PCL is not absorbed by the tissues from the wipe-on coating. GRA

N78-17668 # Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A COMPARISON OF EXERCISE RESPONSES OF MALES AND FEMALES DURING ACUTE EXPOSURE TO HYPOBARIA Ph.D. Thesis
Philip R. Elliott Dec. 1976 155 p refs
(AD-A045383; AFIT-CI-77-1) Avail: NTIS HC A08/MF A01 CSCL 06/19

This study was designed to investigate the effects of acute altitude exposure on selected pulmonary, cardiovascular, and metabolic variables in men and women during submax and max work. All testing was conducted in a hypobaric chamber with each subject being tested initially at the terrestrial altitude of 1576 m to which they were acclimated. Subsequent tests were conducted at simulated altitudes of 2743 m and 3962 m. During the recovery period, heart rate was recorded during submax and max exercise as well as recovery. Minute ventilation, breathing frequency, and oxygen pulse were calculated for submax and max exercise. Mean arterial blood pressure was recorded for submax exercise only. Oxygen consumption, respiratory exchange ratio, and ventilation equivalent for oxygen were calculated for max exercise only. Females tolerated hypoxia better during submax work than did men. During maximal work, the men apparently had a better tolerance for hypoxia than did the women. GRA

N78-17669 # Naval Ocean Systems Center, San Diego, Calif.
RESOLUTION REQUIREMENTS FOR SLOW-SCAN TELEVISION TRANSMISSION OF X-RAYS. A TEST REPORT FOR THE REMOTE MEDICAL DIAGNOSIS SYSTEM Research and Development Report, Nov. 1976 - Jan. 1977
W. T. Rasmussen, R. L. Crepeau, and F. H. Gerber 19 Sep. 1977 76 p
(AD-A047870; NOSC/TR-150) Avail: NTIS HC A05/MF A01 CSCL 17/2

The Remote Medical Diagnosis System (RMDS) is being developed to link ships and shore stations lacking professional medical staffs with larger ships and stations having such staffs. Although RMDS will be capable of transmitting a variety of visual and auditory medical data (e.g., X-rays, ECGs, voice and heart-lung sounds, etc.), its most important use will be for the transmission of high-quality X-ray images. Because of system limitations and other design factors, the resolution of the system must be limited to no more than that necessary for functionally satisfactory performance. As used here, functionally satisfactory performance specifically means that the performance of the radiologist in interpreting X-rays and related data transmitted by RMDS must be substantially as effective as his performance in interpreting original X-ray images. In order to determine the resolution which will actually be required in use of the system, a series of tests was planned and conducted. In these tests, radiologists at the San Diego Naval Regional Medical Center interpreted test X-rays which were displayed at various levels of resolution. The responses of the radiologists were analyzed to derive the minimum resolution levels which would be compatible with system design and operational requirements. The body of the report describes the experiment, the results obtained, and the conclusions drawn from the results including specific guidelines for resolution needed in the RMDS visual channel. Author (GRA)

N78-17670# Medical Care Development, Inc., Augusta, Maine. **ELECTROENCEPHALOGRAPHIC AND GALVANIC SKIN RESPONSES TO VERBAL STIMULI** Progress Report, Sep. - Jun. 1970

Robert A. Cowan Nov. 1977 93 p refs
(PB-274175/9; MCD/ITS-77/02) Avail: NTIS
HC A05/MF A01 CSCL 05J

The electroencephalographic (EEG) and galvanic skin response (GSR) responses of a subject when presented evocative and nonevocative verbal stimuli were investigated. GSR was analyzed according to resistance variation and EEG was analyzed using spectral density curves, autocorrelation functions, cross energy spectrums and cross correlation plots. GSR was found to significantly reflect the subject's appraisal of evocative stimuli. EEG was found to demonstrate a significant increase in energy for frequencies between 15 and 20 Hz and a higher average frequency when the subject was in the evocative stimuli condition. GRA

N78-17671# Civil Aeromedical Inst., Oklahoma City, Okla. **JOB ATTITUDES OF AIRWAY FACILITIES PERSONNEL**

Rodger C. Smith and Gary L. Hutto Aug. 1977 87 p refs
(AD-A046412; FAA-AM-77-21) Avail: NTIS
HC A05/MF A01 CSCL 05/10

A total of 2,366 employees of the Airway Facilities (AF) Service responded to a detailed questionnaire concerning job satisfaction and such factors as salary, shift schedule, workload, and geographic location. In general, AF employees reported satisfaction with employment by the AF Service, particularly in the areas judged most important by them: salary, job security, independence and personal responsibility, and achievement. Dissatisfaction was focused on various aspects of working conditions, such as shift rotation, management effectiveness, promotion opportunities, and paperwork. Detailed analyses of responses as a function of such variables as age, grade level, location, and AF program are presented. The findings are discussed in terms of the implications for improving the job-related attitudes of AF personnel. Author

N78-17672# Calspan Corp., Buffalo, N. Y. **AN ASSESSMENT OF THE ROLE OF SIMULATORS IN MILITARY TACTICAL FLIGHT TRAINING. VOLUME 2: ASSESSMENT BASED ON LITERATURE SURVEY** Final Report, 15 Apr. - 30 Sep. 1976

C. R. Chalk and R. Wasserman 30 Sep. 1976 89 p refs
(Contract MDA903-76-C-0274)
(AD-A040607; CALSPAN-AK-5790-F-1-Vol-2) Avail: NTIS
HC A05/MF A01 CSCL 05/9

The objective of this study was to assess the use of simulators in military tactical flight training. The assessment was made on

the basis of information obtained from a literature survey and a survey of individuals in industry and government agencies who are knowledgeable about flight simulators, military tactical flight training and related matters. Forty six organizations were visited during the survey. Assessments are made of the use of simulators for training the following flight phases or tasks: cockpit procedures, instrument flight, emergency procedures, takeoff and landing, formation flight, aerial refueling, dynamic failures, ground attack, training of maneuver limits, recovery from uncontrolled flight, air combat and nonpilot crew stations. Other aspects of the use of simulators for aircrew training are discussed and problem areas requiring research and development effort are identified. GRA

N78-17673# Air Force Human Resources Lab., Brooks AFB, Tex.

BUFFET SIMULATION FOR ADVANCED SIMULATOR FOR PILOT TRAINING ASPT Final Report

Michael L. Cyrus and Terrance K. Templeton Mar. 1977 13 p
(AD-A040550; AFHRL-TR-77-4) Avail: NTIS
HC A02/MF A01 CSCL 05/9

This paper presents a motion/control landing buffet simulation package as implemented on the Advanced Simulator for Pilot Training (ASPT) located at Williams AFB, Arizona. All primary buffet effects are included. The high level of pilot acceptance and subjective realism indicate a simplified approach to buffet simulation is sufficient for training purposes. Author (GRA)

N78-17674# Texas Christian Univ., Fort Worth. Inst. of Behavioral Research.

MODERATOR ANALYSIS BASED ON SUBGROUPING: PROBLEMS ARISING FROM THE USE OF STANDARDIZED VARIABLES

L. R. James, K. E. Coray, and R. G. Demaree 4 Nov. 1977 28 p
(Contracts N00014-77-C-0123; PHS-DS-01931-01)
(AD-A047892; IBR-77-21) Avail: NTIS HC A03/MF A01 CSCL 05/10

The use of parameters based on standardized variables, such as correlation coefficients or beta-weights, in subgrouping moderator analysis is addressed. It is suggested that a comparison of correlation coefficients or beta-weights across different populations may lead to results that are erroneous with respect to true causal processes. Moreover, it is proposed that even in descriptive analyses, parameters based on standardized data may vary across populations simply because of population specific idiosyncracies. It is recommended that subgrouping moderator analysis be based on unstandardized data and that more attention be given to causal considerations. Author (GRA)

N78-17675* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

WALKING BOOT ASSEMBLY Patent

Hubert C. Vykukal, Alan B. Chambers, and Roy H. StJohn, inventors (to NASA) Issued 27 Dec. 1977 7 p Filed 23 Dec. 1976 Supersedes N77-14742 (15 - 05, p 0661)
(NASA-Case-ARC-11101-1; US-Patent-4,064,642;
US-Patent-Appl-SN-753976; US-Patent-Class-36-92;
US-Patent-Class-36-119; US-Patent-Class-2-2.1A) Avail: US
Patent Office CSCL 05H

A walking boot assembly particularly suited for use with a positively pressurized spacesuit is presented. A bootie adapted to be secured to the foot of a wearer, an hermetically sealed boot for receiving the bootie having a walking sole, an inner sole, and an upper portion adapted to be attached to an ankle joint of a spacesuit, are also described.

Official Gazette of the U.S. Patent Office

N78-17676* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

WRIST JOINT ASSEMBLY Patent

Leendert Kersten (Nebraska Univ., Lincoln) and James Dwight Johnson, inventors (to NASA) Issued 17 Jan. 1978 10 p
Filed 26 Jul. 1976 Supersedes N76-28554 (14 - 19, p 2465)

(NASA-Case-MFS-23311-1; US-Patent-4,068,763;
US-Patent-Appl-SN-708800; US-Patent-Class-214-1CM;
US-Patent-Class-3-12.5; US-Patent-Class-74-515E) Avail: US
Patent Office CSCL 05H

A wrist joint assembly is provided for use with a mechanical manipulator arm for finely positioning an end-effector carried by the wrist joint on the terminal end of the manipulator arm. The wrist joint assembly is pivotable about a first axis to produce a yaw motion, a second axis is to produce a pitch motion, and a third axis to produce a roll motion. The wrist joint assembly includes a disk segment affixed to the terminal end of the manipulator arm and a first housing member, a second housing member, and a third housing member. The third housing member and the mechanical end-effector are moved in the yaw, pitch, and roll motion. Drive means are provided for rotating each of the housings about their respective axis which includes a cluster of miniature motors having spur gears carried on the output drive shaft which mesh with a center drive gear affixed on the housing to be rotated.

Official Gazette of the U.S. Patent Office

N78-17677* National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, Tex.

RESTRAINING MECHANISM Patent

John C. Hardy, inventor (to NASA) (United Aircraft Corp., East Hartford, Conn.) Issued 20 Jan. 1970 3 p Filed 6 Oct. 1966
Sponsored by NASA

(NASA-Case-MSC-13054; US-Patent-3,490,074;
US-Patent-Appl-SN-585217; US-Patent-Class-2-161) Avail: US
Patent Office CSCL 05H

A restraining mechanism restraining a pressurized garment so as to limit its ballooning effect is described. A helically wound spring is bonded at its outer periphery to an elongated flat plate which permits the flat plate to bend in a single direction. The flat plate is attached to an inflatable glove to the palm side for restraining the glove from ballooning when inflated. B.B.

N78-17678* National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, Tex.

HELMET LATCHING AND ATTACHING RING Patent

Edward W. Chase (United Aircraft Corp., East Hartford, Conn.)
and Seppo J. Viikinsalo, inventors (to NASA) (United Aircraft
Corp., East Hartford, Conn.) Issued 13 Jan. 1970 5 p Filed
17 Mar. 1966 Sponsored by NASA

(NASA-Case-XMS-04670; US-Patent-3,488,771;
US-Patent-Appl-SN-535169; US-Patent-Class-2-2.1) Avail: US
Patent Office CSCL 05H

A neck ring releasably secured to a pressurized garment carries an open-ended ring normally in the engagement position fitted into an annular groove and adapted to fit into a complementary annular groove formed in a helmet. Camming means formed on the inner surface at the end of the helmet engages the open-ended ring to retract the same and allow for one motion donning even when the garment is pressurized. A projection on the end of the split ring is engageable to physically retract the split ring.

Official Gazette of the U.S. Patent Office

N78-17679* National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, Tex.

PROTECTIVE GARMENT VENTILATION SYSTEM Patent

Ronald Lang, inventor (to NASA) (United Aircraft Corp., East Hartford, Conn.) Issued 6 Jan. 1970 8 p Filed 6 Oct. 1966
Sponsored by NASA

(NASA-Case-XMS-04928; US-Patent-3,487,765;
US-Patent-Appl-SN-584914; US-Patent-Class-98-1) Avail:
US Patent Office CSCL 05H

A method and apparatus for ventilating a protective garment, space suit system, and/or pressure suits to maintain a comfortable and nontoxic atmosphere within is described. The direction of flow of a ventilating and purging gas in portions of the garment may be reversed in order to compensate for changes in environment and activity of the wearer. The entire flow of the ventilating gas can also be directed first to the helmet associated with the garment. B.B.

N78-17680* National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, Tex.

HELMET FEEDPORT Patent

Ewald Kothe, inventor (to NASA) (United Aircraft Corp. East Hartford, Conn.) Issued 26 Dec. 1967 3 p Filed 30 Mar. 1966 Sponsored by NASA

(NASA-Case-XMS-09653; US-Patent-3,359,568;
US-Patent-Appl-SN-538863; US-Patent-Class-2-6) Avail: US
Patent Office CSCL 05H

A helmet design is described which encapsulates the head of the wearer, is capable of being pressurized and provides a means for gaining internal access for the purpose of eating. A mechanically actuated valve that combines the purging of carbon dioxide and feeding operations by a simple movement of a mechanical lever obviates problems that are attendant in the type of feed and purge ports previously incorporated in pressurized helmets.

B.L.P.

N78-17681* Lockheed Missiles and Space Co., Sunnyvale, Calif. Biotechnology

DEVELOPMENT OF A PREPROTOTYPE TRACE CONTAMINANT CONTROL SYSTEM

31 Mar. 1977 88 p refs

(Contract NAS9-14897)

(NASA-CR-151632) Avail: NTIS HC A05/MF A01 CSCL 06K

The steady state contaminant load model based on shuttle equipment and material test programs, and on the current space station studies was revised. An emergency upset contaminant load model based on anticipated emergency upsets that could occur in an operational space station was defined. Control methods for the contaminants generated by the emergency upsets were established by test. Preliminary designs of both steady state and emergency contaminant control systems for the space station application are presented.

Author

N78-17682# Human Engineering Labs., Aberdeen Proving Ground, Md.

EXAMINATION OF AUDITORY ATTENTION AND VISUAL EVOKED POTENTIALS Final Report

Lynn C. Oatman and Jeffrey H. Lukas Jun. 1977 19 p refs
(AD-A042619; HEL-TM-22-77) Avail: NTIS

HC A02/MF A01 CSCL 05/10

The present research is a continuation into the investigation of the physiological mechanisms responsible for the selective process that controls sensory input to the central nervous system. This experiment was conducted to examine whether visual evoked potentials recorded from the lateral geniculate and visual cortex are suppressed in amplitude during attention to auditory stimulation. The results show that increased auditory attention had no significant arousal effects or changes in the amplitudes of the evoked responses recorded along the visual pathway.

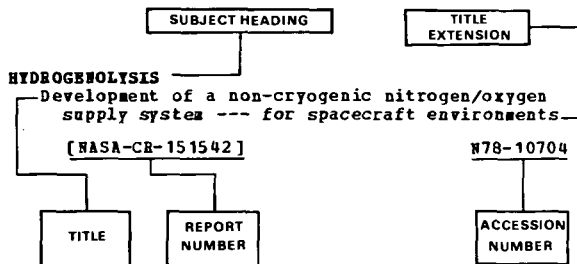
GRA

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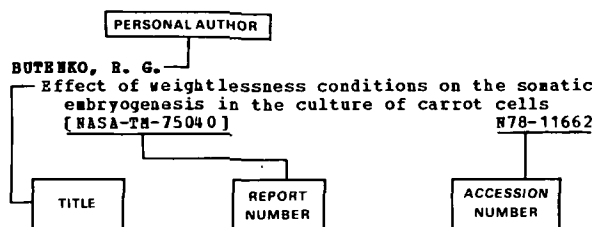
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